

Guglielmus Marconi
9th August 1935

Frontispiece]

MARCONI—
MASTER OF SPACE

An
authorized biography of the
Marchese Marconi
by

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& D. M. B. COLLIER

With Eighteen Illustrations

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To

Her Excellency

THE MARCHESA MARIA CRISTINA MARCONI

I dedicate this story of her husband's
life, in gratitude for her kindness

D. M. B. Collier

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MARCONI—MASTER OF SPACE

CHAPTER I

BIRTH AND CHILDHOOD

APRIL 25th, 1874, in Bologna was a warm spring day. From the early hours of dawn the sky had been cloudless, and a liquid sun rose from behind the roofs of the old houses on the hill to the east to climb against a vault of Italian blue sky. The softness of the morning always remained in the Signora Marconi's mind. Her second child, a son, was born that morning.

From the long windows of her room she had watched the sun sink the evening before, restless with her hour so close upon her. In the years to follow this lady of Scotch and Irish descent was to grow close in mind and sympathy to her second son, who was from the first a bright boy. His half Gaelic half Italian parenthood reflected in his imagination, vivid even in the earliest days of his childhood. He had, too, a curious and intense application to all the childish fancies which occupied his mind.

The Signora Marconi would often talk in later years, when the child she was then expecting had grown famous in the world, of how she found entwined in her memory of that morning the glint of the sun on the roofs and the distant, metallic barking of a dog, which was the last thing she recalled before taking to her bed.

The Palazzo Marescalchi, where Guglielmo Marconi was born, was the town house of Giuseppe Marconi in Bologna. It was to this house that he had first brought his lovely Gaelic bride. Giuseppe Marconi himself had not first seen the light of day there because the home of Marconi's grandparents was some fifty miles from Bologna. Like many old Italian palaces, the Palazzo Marescalchi was rather forbidding in its outward appearance, at least to English eyes, unaccustomed to heavy shutters, necessary to shut out

the overpowering midday heat, and queerly enough on many occasions the intense cold of midwinter.

Actually the Palace stood on a square, unlike a London square in so much that it was private except to those who wished to call and conduct necessary business with the three or four houses which faced on to it. At the back of the house long windows looked out upon a courtyard surrounded on three sides by the wings of the house and on the fourth by a garden and outbuildings.

All the day previously a hushed expectancy had reigned through the house. The doctor had come and gone during the night. A nurse and old servants of the house trod with noiseless steps, and all the business of the household was conducted in whispers. That was why, perhaps, the thin, metallic barking of that dog came to lodge in the Signora's memory as she looked over the courtyard towards the hills, which loomed faintly on the distant skyline, waiting against a background of well-ordered silence, for the birth of her child.

As Marconi was born that sunny morning, the tension lifted. Another boy, it was reported. There had already been one small son of the marriage—Alfonso, born nearly nine years earlier.

Giuseppe Marconi was now the father of three boys. He had one son of a previous marriage—Luigi. Much of the rather solemn and ponderous application to detail which marks some of Marconi's work has come to him from his father. Giuseppe Marconi always managed his estates and his affairs well. He was considered a most capable man of affairs, shrewd and painstaking, and certainly impossible to deceive, even about the smallest detail in any order which he had given to anyone whom he employed. With his fondness for books and his love of peace and quietude, he would have made a good country lawyer of the old school.

Yet Giuseppe in some traits was intensely emotional. He had a genuine and undying love for his country. His marriage was romantic. Marconi's mother was a daughter of the family of Jameson, originally a Scots family who had settled in Ireland, at Daphne Castle, County Wexford. On one side of her family she belonged to the Scottish family of

Haig, and in this way Marconi was actually related to the late Earl Haig.

When Giuseppe Marconi first met Annie Jameson, she was a vivacious, blue-eyed girl with a radiant complexion, and at that time a student of music at the Conservatoire in Bologna. The whirlwind courtship which swept her off her feet had all the elements and settings of a true romance for the Signora Marconi, who had always looked upon Italy as the home of beauty, art and romance. They had been married ten years when Marconi was born.

Giuseppe was sometimes a stern parent. He lacked that imaginative insight, characteristic of his son, and on occasions was impatient with results when the progress of his son's work was in question. The idea of a son of his house interesting himself in science and chemistry was not, he considered, to be taken seriously. It may be said with truth, though, that he did encourage Marconi in his early work, particularly after some small results had been obtained. He gave the boy every facility—and money, though this necessary commodity was only doled out rather grudgingly, after due explanation.

Actually the old man was rather proud of his business ability, and it pleased rather than displeased him when people described him as a keen business man. Such a reputation enabled a man to do better business when it came to making a purchase or entering into a contract.

His pride in business reputation is well illustrated by the fact that the old man never tired of hearing the story of how he might have contributed to the rebuilding of the historic Cathedral of San Petronio. A good story indeed—and truly characteristic of him.

The Cathedral is an historic monument, dating in the main parts from the fourteenth century. The inhabitants of Bologna have always been justly proud of this fine building, and anxious that it should be kept in good repair. With this object in view, a number of citizens, more artistic than practical, planned how a new façade might be built. After setting out their scheme, with suggestions as to the time it would take and the money which would be required, they decided to approach Giuseppe Marconi, in order to ask him

for a donation. Surely such a patriotic citizen of Bologna would do something for them. So with a fair assurance of success they approached him. In his rather dry way, he listened carefully to all their plans, making, however, little comment. Finally he delighted them by his expression of desire to help and offered to make himself responsible for the surmounting cross, which would in itself be a somewhat expensive matter, but of course would not be needed until the entire work of building the new façade had been completed.

If you visit Bologna to-day, you will still find a famous landmark in the Cathedral of San Petronio, but they are still talking about building the new façade, though they have long given up making plans. Anyway, Giuseppe Marconi retained his reputation for generosity and saved his money.

Of his early years, Marconi says: "I was not a good boy." He was, in fact, mischievous and more than a little obstinate. He suffered from the fact that his brother, Alfonso, was a model child, neat, studious, and invariably well-behaved. But Guglielmo was always a favourite with his mother.

A few weeks after the birth of their second son, the family moved from the Palazzo Marescalchi to their country home, the Villa Griffone, at Pontecchio, near Bologna. As a baby, Marconi must have spent many sunny hours on the terraces and among the chestnut trees which saw the first experiments the world knew in sending messages by electricity through the air. Just as the Palazzo in Bologna has been marked by the Italian Government, when thirty years later a commemorative plaque was unveiled, as Marconi's birthplace, so has this avenue of chestnuts been marked as the birthplace of wireless telegraphy. Along that avenue of trees the first wireless messages were sent.

Marconi himself has said that he was not a clever boy, although he never lacked imagination. His early schooling was not marked by any brilliance, and of his younger days, Marconi has said: "It seemed I was restless. In any event, I was always in some scrape."

As he grew out of childhood among the chestnuts and the terraced gardens at the Villa Griffone his mother became

increasingly aware of the boy's peculiar powers of concentration. Guglielmo had a way of living in a little world of his own creation to the exclusion of all else. He had no special bent at this early age, his interests being transient, but it was an essential fact that his interests from the first were always marked by unusual keenness. It was this trait in his character which led him to cling so unrelentingly to his ideas later, when almost everyone except his mother and his few helpers were treating his experiments and his amateurish apparatus as a huge joke.

Of Marconi's boyhood there is one characteristic, not easily translated into terms of ordinary experience, which more than any other brought to a practical issue his experimental theories of wireless telegraphy. Throughout his entire career, Marconi has been able to commend willing help and co-operation among his immediate associates. Edison said of him, "He looks like a good man to get along with." This was always true, particularly of his fellow-workers.

Even at quite an early age Marconi had a band of willing assistants in the sons of men who worked upon his father's country estate, the Villa Griffone. It was, in fact, one of these boys who became the first paid assistant in the wireless telegraphy industry, for Marconi paid him a small weekly sum for the work he did in helping to fix up what appeared to ordinary people mazes of wire and strange pieces of wood.

His brother Alfonso, and frequently his half-brother Luigi, helped him with many of his boyhood experiments, and what also meant a great deal to him, they believed in him. They, however, held themselves more aloof, as it was their nature to do. It was Marconi only who fired the imagination of his band of young workers.

In strange contrast to the events of his second visit, Marconi does not recall his first visit to England. He was about three years old and the family went to live at a large old-fashioned house on the outskirts of Bedford, known all over the world as the birthplace of John Bunyan. Colleorton Villa, Bedford, still stands, but how few people know that once its old-fashioned, oak-panelled passages re-echoed to the pattering footsteps and laughter of Marconi and his brother.

After about three years the Marconi family returned to Italy and went to live once more at the Villa Griffone which, with its surrounding land, was a more suitable home for growing boys than the Palazzo Marescalchi would have been.

It was at the Villa Griffone that Marconi's first education began; previously he had only received such lessons as his mother and nurse thought necessary to occupy his childish mind and keep him out of mischief. A tutor was engaged, so that when the family moved to Florence or Leghorn for the winter his studies were not interrupted.

The winters are severe in Bologna, and the Signora Marconi's health was affected by the cold, which was the principal reason for this annual family migration.

It was while they were in Florence during a winter when Marconi was about fourteen, that Giuseppe Marconi decided that the time had arrived when his son should go to a college. As the result of this resolution he was sent to the Institute Cavallero in the Via delle Terme, and it is here that his interest was first turned to the study of chemistry and physics.

When the family took their next winter sojourn, it was in Leghorn; here Marconi appealed once more to the sympathies of his mother, and through her influence he was allowed to attend the Leghorn Technical Institute. His keenest interest was now centreing on the exact science of physical chemistry. It no longer wandered, and with that painstaking passion for concentration, he was devoting his mind to the subject.

With his attendance at the technical school Marconi became so engrossed in his work that his mother became anxious about him and feared that he might injure his health. She consulted a doctor who wisely told her that more harm would be done by trying to get the boy away from his work. "With a boy like that," he said, "you should try encouragement."

Partly at his own request and partly upon the advice of friends the Signora Marconi took her son to Professor Rosa, who was a well-known lecturer at the University. He was much interested in the young Marconi, and it was arranged at once that he should give him private lessons.

He was indeed getting to grips with his subject, and science was rapidly becoming the greatest and most absorbing interest in his life.

It must not be imagined, though, that Marconi was a prig, who studiously avoided all forms of amusement and recreation; this impression would be far from the truth. Without being unduly tiresome he had the usual boy's ability for getting into scrapes, but some of his earlier recreations show that he must always have been very level-headed. He was always extremely fond of the sea; at nine years old, he was able to sail a small boat, and with his brother he spent many happy hours in the bay off Leghorn.

As a young man of twenty, Marconi's aim was to acquire an ever-increasing knowledge of physics and chemistry. That in itself was an end. His father kept him provided with funds, though it must be admitted that the elder Marconi never parted with money for his son's experiments except under protest. A request for another 100 lire or so was not granted without a full explanation as to how it would be expended, and every inventor knows that it is extremely difficult to estimate the exact cost of perfecting an experiment in the initial stages. His mother looked after his physical needs; Marconi did not look beyond this in daily affairs. The whole of his mental and physical energy were directed unerringly towards one mark. Nothing could deflect him from that when he was twenty years old. Nothing has done ever since.

During the summer of 1894, he went with his brother and half-brother to the mountains of Biellese, and whilst in these Italian Alps an idea came to him. From that moment in which he lay, half awake, half asleep, in a strange bed in that Alpine hotel—he was convinced that electric signals could be sent through the air from one place to another. He was, he says, finding sleep elusive and with the smell of the pine-trees in his nostrils and the creaking of timbers about the old inn, it seemed likely that he would still be awake when the sun was up. From worrying about this minor detail, his mind turned to thoughts of Hertz and his experiments, and it was as he considered and contemplated upon what Hertz had achieved that a conviction came to him.

He recalls that he had made a momentous decision before sleep finally claimed him. When he awoke in the morning, the thoughts of the night before had not vanished entirely as is so often the case in such circumstances. He thought again and felt more than ever convinced that wireless telegraphy was possible, not merely an inventor's dream. From that moment he set about making it a reality in this world, with a painstaking application to detail which was indeed worthy of his father Giuseppe.

Of this ambition, Marconi says, "The idea of transmitting messages through space by means of etheric waves came to me suddenly as a result of having read in an Italian electrical journal about the work and experiments of Hertz."

Marconi at that stage of his career, seldom missed reading any Italian publication which might be likely to tell him anything about his cherished ambitions. "It was a long and interesting article; Hertz had just died—actually in the preceding January. The idea obsessed me more and more, and in those mountains of Biellese I worked it out in imagination. I did not attempt any experiments until we returned to the Villa Griffone in the autumn, but then two large rooms at the top of the house were set aside for me by my mother. And there I began experiments in earnest."

Marconi had the key of these rooms and even when he was working in them on his experiments he kept the doors locked. He rose early to get back to his work, and he worked late. His mother was concerned to see, night after night, a light burning at the top of the house, and she would often knock softly on the door before retiring to bed. A dishevelled, untidy young man would open the door for her and draw her inside, showing her his batteries, the home-made apparatus, the seemingly endless tangle of wire and coils.

"I think you should go to bed," his mother would say.

"I will when I'm tired," was his invariable answer. They usually spoke English together.

Signora Marconi was allowed inside the room, but no one else. Old Giuseppe was provoked to mild complaint when he learned that servants were only permitted inside the rooms on rare occasions, strictly supervised, in order to remove dust and dirt.

"What is there about these things he is making that calls for a state of siege?" the old man asked.

"Other people disturb his experiments," Marconi's mother explained. "It is not much to give him two attics for himself."

"He is never out of those rooms. Perhaps he has told you what his idea is; for my part, I must confess that he leaves me entirely in the dark."

And on that memorable occasion Signora Marconi sat herself on the arm of her husband's chair. "His idea," she said softly, "is that it is possible for signals, voices even, to be sent from place to place, through the air. . . ."

The old man had wrinkled his brown incredulously at her and was on the point of expressing himself suitably on the subject of voices in the air, when he stopped himself abruptly. There was something in the Signora's eyes put there by faith in her son: the Signora was a lovely woman, and her eyes were by no means her worst feature. Marconi had his first, and for all time his most faithful, disciple in the Signora, his mother.

"Well, let him experiment," the old man allowed, gruffly. "Yet, it would be pleasant occasionally to see something of one's son."

Marconi has always been self-reliant and sparing of words. In those early days he told no one except his mother of his hopes. His was a sensitive nature, and he shrank from mockery or even lack of sympathy in others. At the time of his first experiments that incongruous streak of common sense told him that his idea, that aim which was such a reality to him, must indeed show fantastic in the eyes of others. He took pains to avoid bringing his ambition to the crude test of common criticism. He has been thought indifferent to the opinions of others. He has been written down as taciturn and unmindful of the niceties of intercourse. Marconi is, and has always been, essentially retiring by nature, and rather oversensitive to adverse criticism. He has confessed that his early attachment to fishing of any description had its origin in his wish to get away from others, and gain for himself the opportunity to think without feeling either selfconscious or that he was being inconsiderate to others, who might wish to

talk. This, perhaps, accounts for the fact that as a fisherman, Marconi has never been as successful as he would have wished. Though he admitted, "I have caught some good-sized fish in my time." In later years he indulged in this hobby on his visits to Ireland, where his efforts were not always ill-repaid.

In those two rooms at the top of the Villa Griffone Marconi made with his own hands most of the apparatus he used. The result of his untutored efforts was not neat, and this not because Marconi was not deft with his fingers, but because there were scarcely any of the devices he required manufactured; practically everything which he used had to be home-made or contrived. Much of the apparatus he used then makes him smile now. This mattered little, however, for his purpose was fixed and his purpose keen. In many of his early experiments Marconi was complimented by his friends and assistants on his capability of making instruments and devices which fulfilled their purpose from the most primitive beginnings. Probably this was due to his vivid imagination which always enabled him to foresee just how a certain thing would turn out in the end. All during his career this ability has served him to very good purpose. Time did not exist in his schedules. The experiments went through: and if he did nothing of a constructive nature to allay the fear that existed in the minds of the maids at the Villa Griffone that sudden death lurked in the strange pots which housed his batteries at least he saw to it that if his experiments went wrong—which they almost invariably did—his was the hand responsible for the failure.

For detecting the waves radiated from his transmitting oscillator, Hertz had used a metal hoop which had a small gap at one side. When this hoop was brought within the influence of an electrical disturbance set up by his oscillator, minute sparks crossed the gap.

Hertz contended that this gave proof that electric waves when radiated into space could be detected by means of a metal hoop. This theory was the basis of Marconi's experiment—and the intricate structure of his high ambition.

"It seemed to me at this time," Marconi says, "that if this radiation could be increased, developed and controlled,

it would most certainly be possible to signal across space, for very considerable distances. My chief trouble was that the idea was so elementary, so simple in logic, that it seemed difficult to me to believe; no one else had thought of putting it into practice. Surely, I argued, there must be much more mature scientists than myself, who had followed the same line of thought and arrived at an almost similar conclusion. From the first my idea was so real to me that I did not realize that to others the entire theory must appear quite fantastic. A problem is always simple—when solved. To radiate was not easy, and there were a thousand and one things to make the pioneer's path difficult. From the beginning I aimed at interfering with the radiation from the oscillator, breaking the emission up into short and long periods, so that the semblance of a 'dot' and dash could be transmitted. It was in December, 1895, that I first succeeded with my radiation problems. The winter was severe, but my mother decided that she would stay with me at the Villa Griffone, so that she could be near me at my work; she was deeply interested in all the work I did and every step of progress, which I made, however small and apparently unimportant it might be."

It was indeed a proof of the depth of the Signora's interest that, despite her delicate health, she prevailed upon the family to change from their usual winter habit—and remain at the Villa. She always kept an eye on the light that burned at the top of the house half the night, and mounted the stairs from time to time to knock on the locked door. Occasionally a maid would accompany her bringing a tray of food to the young man, who sometimes forgot that meal-times existed. For all this she was in her own heart well rewarded.

The Signora, one December night, had retired to bed, leaving the Villa in quiet and darkness, except for the light in the attics. Guglielmo had promised, when she knocked on his door, that he would not be long that night before he, too, was in bed. She had been asleep for some hours when a hand, shaking her shoulder, woke her. By her bed she saw Guglielmo, with a candle in his hand. That firm mouth of his was firmer, and the wavy brown hair that dragged over his solemn forehead was in more than customary disorder.

"Come, mother," he urged, "let me show you."

With the Signora there was no need for explanations. She knew. Clothing herself in a dressing-gown she slipped her arm through that of her son, and together they climbed the stairs.

"You're cold, boy," she said.

"I have finished now, mother, for to-night," Marconi told her absently. "I want you to see."

The long attic rooms were lit by lamps, and in the yellow half-light Signora Marconi saw at one end a mass of apparatus that even her sympathy could not make her begin to comprehend. A tangle of wiring loomed above this apparatus. Through the archway, in the attic beyond was a compact group of batteries, zinc rods, and coils. At their side, as they stood, was a small table on which was a key.

"Listen, mother," said the boy. He pressed the key.

From the far end of the attics came a buzzing. The Signora, shivering in her peignoir, waited for more. But that, it seemed, was all. "It's wonderful!" she said.

With an arm round her shoulders Marconi took her back to bed. And wonderful it was. He had succeeded in making an electric bell ring. This had been done by means of a radiation at a distance of some 30 feet across space.

Later this young man was destined to bridge the English Channel with messages carried in a manner unknown to the world on that cold December night, when he burned his light late into the night in order to turn his dreams into undisputable facts. Later still the vast Atlantic Ocean was to be bridged, but it would be scarcely true to say that even these two great epoch-marking events gave him a greater thrill than when the electric bell connected with his experimental set tinkled out its shrill note.

Giuseppe Marconi was not as enthusiastic as he might have been over such an event; a bell could be made to ring by more than one means, he thought—but the bell made history.

CHAPTER II

EARLY EXPERIMENTS

THE Villa Griffone at Pontecchio is a large stone house in the Italian style, standing in its own ample grounds. The gardens at the time of Marconi's experiments were beautifully laid out, for this was an Italian garden, and the Villa Griffone was old Giuseppe's pride. Green shutters relieved the pastel white of the walls, and lawns and terraces fell away on three sides to reveal the famous avenue of chestnuts trailing away into the distance—a distance streaked with the long purple line of the hills.

With the spring of 1895 Marconi began experiments in the grounds of the villa. The return of the family found him literally entrenched about the terraces, which descended in gentle steps to the avenue. For many weeks he rose early every day to work at his experimental apparatus before the household was astir. Giuseppe was inclined to view with anything but enthusiasm this encroachment upon his garden, and it was young Marconi's habit to work early and late, leaving the normal day-time hours free from liability to complaint about tripping over wires on the terraces. Those early morning hours made a deep romantic impression on Marconi. He frequently recalls them. His outlook was always sensitive to imaginative persuasions.

As he watched them for a moment before beginning his work, those distant hills in the cold half-light would take on the semblance of drifting fleecy clouds that had, for the moment, been frozen into stillness. The smell of freshly-turned mould to-day still brings back to him the misty tang of those springtime mornings, with the bold trees of the chestnut grove marching down in column to cut across the rising mists of the valley. And as the sun came up, changing in its climb from a wet-bottle golden disc to a rosy centre of radiance, taking up the damp chills clinging to the gardens of the Villa Griffone, young Marconi would set to work digging,

to bury may be, a metal plate, or else he would be climbing a tree to fix a wire, weaving all the while in his mind the gentle softness of the morning as a pattern and background for the crowding hopes with which his head was filled.

"His head," Giuseppe was fond of saying, "is full of fantasy. One wonders that it ever occurred to him to think about eating or sleeping."

Behind his reserve Marconi still conceals a vivid imagination. He will tell you to-day that his memory of early ambitions is inseparable from that misty stillness, of the gardens at the Villa Griffone. For him, his early experiments are still enshrouded in the pungent smell of wet earth and of branches of chestnut-trees heavy with the morning dew.

In the evenings, and the mornings too, Marconi frequently had the help of not only his brother, but some other assistant. It has already been explained that the Villa Griffone was surrounded by a good many acres of land. The elder Marconi employed a good many gardeners and other workers to keep it in order. It was from the younger of these workers and their sons that Marconi drew his earliest assistants. Usually one of these assistants would be stationed by the receiver set in the distance among the chestnut-trees. And often old Giuseppe, looking out upon his terraces and gardens would see a man dancing about among the trees as if he were possessed of devils. This would probably be his elder son, Alfonso, signalling to announce that some signal had been received; but Giuseppe had other theories in mind as he turned back, none the steadier to his shaving.

Marconi's first experiments at longer range than he could get indoors were carried out with an induction coil as a Hertzian emitter. He used in the beginning a ball discharger which Professor Righi—who was a neighbour—had designed. This ball discharger consisted of four brass balls, separated by small gaps, and immersed in vaseline. To control the discharge across the spark gap, a Morse key was inserted in the primary circuit of the induction coil. When the key was held down a long spark passed between the gaps, sending out a "dash." When the key was quickly depressed and released a Morse code "dot" was sent out.

The move from the two attic rooms, following the success

with the buzzer, was made largely as a result of Marconi's discovery that elevated transmitting and receiving aerials increased the range of transmission. And after he had begun work in the grounds of the villa he added a further important discovery.

Instead of using two rods of the Hertzian oscillator, he connected one terminal of the secondary winding of the induction coil to a metal cylinder (or capacity). This he placed on top of one of the poles he had set up. The other he connected to a metal plate in the ground. He thus constructed apparatus which, from an elevated aerial, discharged across a spark gap to earth.

At the receiving end he had a similar capacity at the top of another pole. This apparatus increased the range of his signals considerably. The poles erected about the place became a permanent feature of the landscape, for Giuseppe, to his secret sorrow was, at length impressed by the success of his son's efforts. It seemed to him still a long way from voices in the air, but it was, nevertheless, getting on that way. The old man resigned himself to having his garden disorganised and plates of copper dug into the good earth.

Early in his experiments Marconi found that the receiver was the least effective part of the existing apparatus, and in order to increase its effectiveness over long distances an exceedingly sensitive receiving device was necessary: he improved the Branly Coherer.

As early as 1870, S. A. Varley had endeavoured to send a current through a mass of carbon granules. Tiny particles arranged themselves in order under the influence of an electric current, then offering a free passage for the current. When shaken apart again they resisted the flow of the current, until it again became powerful enough to make them rearrange themselves in a kind of bridge for the current's passage.

That was roughly the principle of the coherer. Professor Calzecchi Onesti carried experiments further, and Professor Branly took up the work in 1890. He arranged metal filings in a small glass tube 6 inches long, and constructed a "tapper" to disarrange them after they had been brought together under the influence of the electric current.

When Marconi used the Branly coherer he mixed nickel with a small proportion of silver filings for powder. This was placed between silver plugs in a small glass tube. Marconi decided to improve upon the Branly coherer. It was not sensitive enough. He adopted a much smaller tube, reduced the gap between the plugs, making them of silver and arranging them so that they should fit tightly into the tube. The ends of these plugs were not only highly polished but there was a slight amalgamation of mercury. Connections which were made between the tubes were of platinum wire, and these latter were brought out at the ends of the tubes. Finally the ends of the plugs were made wedge-shaped. By this means the tube could be turned to different positions and the width varied between the two plugs.

Marconi can speak with a smile now of the hours of patient study which he spent determining just how to adjust these plugs. Sometimes the slowness of it all and the many obstacles to be overcome proved most depressing, then suddenly there would be some little improvement. At first the waves were too feeble to operate the receiving mechanism, but strong enough to arrange the particles of sensitive metals in the tube. A local battery current could, however, he passed through the particles. This current from them could operate a telegraph relay, which in turn operated a Morse instrument.

By the end of the year there was great joy in the Villa Griffone, when messages could be sent more than a mile. Marconi's brother, Alfonso, became deeply interested in the experiments now, and Giuseppe himself attended with ceremony an exposition of the wonder that had come within his household, when Marconi and his two excited assistants gave a demonstration of sending signals across space to a receiving station *out of sight* over the brow of a hill!

At the foot of the terraces Marconi showed his father how to send the signals, by depressing the key. The old man turned his eyes from the key to the aerial overhead, and from the aerial to the distant figure of the perspiring young man stationed on the skyline at the top of the hill. As he watched, that young man began the well-known antics of leaping into the air and waving arms and legs about indiscriminately.

"He has received a sign from an assistant at the receiver



MARCONI, AGED 5, WITH HIS MOTHER AND ELDER BROTHER ALFONSO

that my signals have been received," Marconi told his father.

"I would like to be at the receiver," Giuseppe conceded. He walked over the hill. Undoubtedly Guglielmo produced Morse signals and strange buzzing sounds from his strange and primitive-looking apparatus.

The painstaking construction of the improved coherer that made these experiments successful is typical of Marconi's untiring efforts. From his mother, it seems, he inherited the imaginative insight that gave him vision: from his father, the power of concentration and tenacity of purpose that gave him driving power. That early coherer owed a good deal to the tough strain in Giuseppe.

With the use of elevated transmitting and receiving aerials Marconi began to make rapid progress in the grounds of the Villa Griffone. He devoted his time and energy to improving his appliances and by the beginning of 1896 he was sending signals over a distance of 1¾ miles from his transmitting station (at the foot of the terrace). The first part of the pioneering work had been done. New vistas were opening for him, and now at last he had the full approval and active co-operation of his father.

As may well be imagined, Signora Marconi was filled with pride at the wonders accomplished by her son, and she became increasingly anxious that he should win recognition in the land of her birth as well as the land of her adoption. There were long letters written by her from the Villa Griffone to her kinsfolk in Ireland, and it is certain that these letters were ultimately responsible for Marconi's activities in this country. From the first, Marconi had a hard fight against those who thought that nothing of a considerable nature could come from one so young, but it is to be recorded that from his relatives in Ireland he received nothing but encouragement from the first moment they heard of his activities.

Negotiations between England, Ireland, and the Villa Griffone led to suggestions, suggestions to invitations, and invitations to letters of introduction. Old Giuseppe had nothing to say against the project; in fact, he knew that his wife would welcome a visit to England, as an opportunity of meeting some of her relatives and a number of old friends,

made not only in her girlhood, but in the days when the family lived in Bedford.

Finally then, as a result of all these arrangements, Marconi left his home for London in February, 1896. Because he wished to continue with his experiments, both Marconi and his mother were agreed that a fashionable hotel would not be a suitable place for them to stay at during their visit to London.

It was with the idea of finding somewhere quiet that Colonel Jameson Davis, a kinsman of Signora Marconi, and afterwards founder of the Marconi Company in England, was approached, and through his recommendation a comfortable *pension* was found, situated in a peaceful square.

In a way, the farewells at the Villa Griffone had been rather sad; he would liked to have brought all those who had so eagerly assisted him to London, but obviously that would have been quite impossible. It must be remembered that Guglielmo was still only twenty-two, and it saddened him to hear his father and Alfonso wish him good luck, bringing the fact more vividly to his notice that they were not coming with him.

Despite these minor misgivings though, it was with a keen sense of anticipation that he set off for England, accompanied by numerous packing-cases, trunks, bags, sacks, and other receptacles, of which luckily only one went astray (and that turned up in due course, after a few anxious enquiries had been made by the youthful traveller).

He was able to set up some of his apparatus in the *pension*, and so it was not very long before he was really duplicating his old life at the Villa Griffone, though naturally under very different conditions. In some ways English people seemed to Marconi peculiar: they did not look at things from the same view-point as his Italian associates, and this led to many a surprise, because his appearance was so entirely English that almost everyone whom he met in London forgot that he was an Italian, a fact accentuated by his fluent English, spoken without a trace of foreign accent.

Almost the first incident of importance after his arrival in London was his meeting with Mr. (afterwards Sir) William Preece; he had already heard about Marconi's experiments

and had, in fact, carried out a few himself. Mr. Preece was at once enthusiastic about the notion that Marconi should carry out an officially witnessed experiment in London, and promised that he would get something fixed up as soon as he could.

Every day Marconi anxiously awaited some news, and the postman's knock always brought with it a keen thrill of anticipation. At last one morning by the early post, a large envelope arrived, complete with red seal and those letters O.H.M.S. which mark communications from His Majesty's Government. For a moment Marconi looked carefully at the letter—then he opened it.

It was from Mr. Preece, Engineer-in-Chief of the General Post Office. As Marconi read that every facility was to be given him to give a demonstration of his apparatus before the Post Office engineers, the line of his firm mouth hardened. He read the latter again, slipped it back in the envelope, and put it away in his pocket. He knew then that the test of all his hopes and labours was at hand.

The sitting-room of his pension had long windows with that type of academically interesting balcony which at some time in the history of the building of London must have known great favour. As he reflected on this letter Marconi moved to the windows to look out over this nine inches of hypothetical iron-work into the plane-trees which, after forty years, had not died yet behind the railing, encircling the centre of the square. Sparrows were hopping, lively enough, in and out of the railings, and against the skyline on the far side of the square was arrayed the dirtiest and craziest collection of London chimney-pots an Italian youth could imagine. Those broody plane-trees were very different from the chestnuts.

Marconi confesses that he was thinking then for the moment of what would happen to his little world if his tests failed, or if these English, who were so hard-headed and clever and enterprising, with half the world under their rule —if they told him, smilingly, that what he had to show them was long since common ground. Not only the chestnut-trees seemed far away from him them, but his father and brother. However, he thought of his work, and confidence returned to him. Without waiting to find his hat (in truth a very un-English headpiece, shown in authentic contemporary

photographs to be peaked both fore and aft and constructed in confusing design of check tweeds, culminating in a button), he ran out of the house to telegraph to the Villa Griffone.

Marconi himself now says that never for a moment did he seriously doubt that his demonstration before the officials of the Post Office would be successful, yet there was a feeling of tense anxiety. Finally the call came, and a busy time in that little laboratory followed. The apparatus was carefully dismantled; electric gear studiously packed; the hundred and one oddments of scientific experiment were assiduously crated. The roof of the General Post Office at St. Martins-le-Grand was the spot appointed, and it was here that Marconi assembled the gear which was to prove his faith.

That day he worked long, consumed by the enthusiasm that had animated him from the first. It had been arranged by Preece that the young Italian inventor should transmit signals from the General Post Office to a receiving station (also erected by Marconi) on the Thames Embankment.

The day of the demonstration dawned. As usual, Marconi was up early in the morning. He spent busy hours checking and re-checking the apparatus he had made, the materials he had used. When the hour of the demonstration arrived he dressed himself carefully and made his way on foot to the General Post Office.

Officialdom was there. Elderly men with grey hair, with experience reaching back into the years; younger men representing vested interests, distinguished government officials, Post Office experts. They were all there to meet this shy young Italian. For Marconi it was a nerve-racking reception, lessened, however, by his inward assurance that he really had a sound proposition to put forward. Even to-day he will deny that he is shy or retiring, but he still intensely dislikes making speeches or talking to people on set subjects. As a youth he was, and has remained ever since, a man of ideas and action rather than words.

The greetings and hand-shakings were over at length. The official party moved up to the roof. William Preece laid a kindly hand on the young man's shoulder, conscious of the nervous strain such an experience must impose on one of such tender years. "Now, Mr. Marconi," he said.

From the group of expectant officials, Marconi's eyes shifted to his assistants standing beside the crude self-made apparatus, every millimetre of wire of which he knew like the back of his own hand. He moved over to join them. The time had come.

He pressed the Morse key himself, transmitting the preliminary signals arranged. A moment's tense pause, then back came the answering signals.

Then, with the help of the Post Office Clerks, he despatched a telegram, and the message was received without the need for repetitions on that roof-top down by the river. Other messages followed this success, and then came long explanations, examinations of the apparatus he had invented, designed and made. This day was indeed an epoch-marking one, not only was it an unqualified success for Marconi, but it actually marked the beginning of the British Government's interest in wireless. Marconi had proved that the theories he had put forward could be put into practice and were not mere vapourings of the Latin mind. Certainly there was apparatus enough, the quantity of electrical gear to be seen should have convinced the dourest of Scots.

Curiously, the demonstration at the General Post Office did not excite public interest in anything like the degree which later ones did. It may be that many people felt that anything in connection with the Post Office could not be very thrilling.

Shortly after this preliminary success, Marconi was invited to give another demonstration, this time before officers of the Army and Navy, in addition to the Post Office engineers. This took place on Salisbury Plain, and after certain necessary trials and adjustments Marconi succeeded in sending messages 4 miles, 6½ miles, and finally 8 miles.

Salisbury Plain has been the scene of many events which afterwards became landmarks in English history; surely not the least of them the wireless trials which took place on that bright sunny morning, when all was peace around, and there were few sounds to interrupt the stillness except the song of an occasional lark, as it rose from its grassy nest into the blue vault of the sky above.

These first Post Office demonstrations led to another

event which was not considered of sufficient note at the time to warrant a newspaper story, but had a far-reaching effect as far as Marconi was concerned. Mr. Preece assigned as an assistant to Marconi, a man who had been employed for some time as an engineer at the General Post Office. James Stevens Kemp was his name, and all through the history of Marconi's successes Kemp held important place until his death in 1932.

Actually the story of the first meeting of Marconi and Mr. Kemp was a romance in itself. The inventor had promised to fix some wireless equipment on the roof of a friend's house. He was busy doing this, working himself on the roof with sleeves rolled up, endeavouring to fix coils of electric wire to the chimney stack. Looking down towards the street, he saw a man watching him with evident interest. "What are you doing?" he asked. "Come up and help me," replied Marconi promptly, "and I will soon show you." Without further argument or wasted words, Kemp, for it was he, swarmed up the water-pipe which ran up the side of the house and quickly got to work, in such a manner that the inventor was really surprised at his skill in handling apparatus of which he could have known very little. It was afterwards, when he mentioned this to Mr. Preece, that the suggestion was made that Kemp should become Marconi's assistant—thus a chance meeting led to a partnership of work, only severed by death.

The next step was when both Marconi and those who supported him, thought that experiments should be made over water. The Bristol Channel was chosen as a suitable spot. From Penarth to Bream Down, near Weston-super-Mare, ranges first of 3, then of 4 and afterwards of 9 miles were obtained. There was a distinguished witness of these last experiments, about whom a great deal more was to be heard later. Professor Slaby, of Berlin, who had been experimenting for some time with Hertzian waves, was sent specially to England by the German Emperor in order that he might witness the experiments.

Even in those days the Emperor had for his aim and motto "Deutchland uber Alles", and why not in a new experiment like wireless as in anything else? Later wireless

history shows how the best-laid German plans failed to mature.

Marconi at this time began to experience some of the penalties of fame. He did not mind how often he was called upon to repeat experiments, or how he had to work, but speeches were things he took pains to avoid. He was not socially a great success. His own explanation of this is, not that he was actually nervous, or even unduly shy, but he disliked meeting strange people and detested having to talk just for the sake of talking. He was naturally reticent. One important point must not be overlooked when comparing Marconi's early life and career with those of other young men who eventually rose to fame and eminence. He was never poor, therefore he was not forced by the necessity for money to ingratiate himself with men of substance or power. Unlike many youths of the same age, he was entirely devoid of extravagant tastes. In 1896 he registered his first patent, a concrete result of his experiments; several others were taken out within a short space of time, and a considerable amount of money came into the hands of the young inventor. A few friends suggested that he would like to buy this—or that—or do this, now that he had money which was really his own and not given by his father. Marconi, entirely heedless of these remarks, merely bought the only thing he wanted, a bicycle, and he did not choose the most expensive he could buy, but one which he thought would prove strong and serviceable.

Sir William Preece was not only one of the first important men in England to take an interest in wireless telegraphy, but the first to take practical steps to interest all classes of people in it as well. With this object in view, he gave a number of lectures in various districts and to different types of people.

Toynbee Hall, Whitechapel, has been the scene of many interesting events, but there had seldom been a larger audience gathered in the lecture-hall than that which gathered to hear Preece lecture on wireless telegraphy, one evening in 1897.

The large attendance may have been partly due to an interest in wireless, and certainly Preece was a popular lecturer, but undoubtedly the attraction of the evening was the opportunity for most people to see this unknown young

Italian inventor for the first time. It had not been greatly advertised, but the news had got round, as such rumours do, that Marconi would be there.

At the close of the lecture the chairman called upon him to speak, which he did, in a most pleasing manner and amid much enthusiasm, though nothing he said that evening was of historic import.

June, 1897, was an eventful month for Marconi. Already a tremendous mass of work lay behind him and now came an invitation from the Italian Government to go to Rome and Spezzia, where a land-station was erected later under Marconi's personal supervision.

This meant home again for Marconi, for a time at least—the Villa Griffone in June, with its sunlit terraces and rose-hung pergolas. He left London without regret.

Upon his arrival in Spezzia communications were attempted with Italian warships at sea; after he had seen these carried out successfully, he travelled to Rome in order to carry out further demonstrations from there.

Here more successful tests were carried out, in the presence of the King and Queen of Italy. King Humbert was much interested and followed every detail, and constantly questioned the inventor. Queen Margharita was even more enthusiastic, for she looked upon this new invention as a great scientific triumph for Italy. To use Marconi's own words, "The Queen was most gracious to me and asked me many questions as to what experiments I intended to attempt next, how far I thought messages would be sent eventually, and so on."

Other tests took place at the Italian Chamber of Deputies, and the Chamber was most enthusiastic, promising him all the assistance he required. It was in return for assistance that Marconi made special arrangements with the Italian Government, so that when "The Wireless Telegraphy and Signal Company Ltd." was formed, it was formed to acquire Marconi's patents in all countries, except Italy and her dependencies. This was the company which had its name changed in 1900 to "Marconi's Wireless Telegraph Company, Ltd."

The company was formed on Marconi's return to England,

and its first work was confined to furthering the pioneer work which had already been commenced. Marconi had started things moving; interesting tests were now made around the coasts of the British Isles, as well as abroad. A station was erected at Alum Bay, in the Isle of Wight, and another at Bournemouth. At the former station the masts were 120 feet high. The Bournemouth Station was afterwards removed to Poole, fourteen miles from Alum Bay.

All during October of this same year, 1897, Preece was busy making experiments at Dover, using all the while the Marconi apparatus. He was convinced by this time that it would not be so very long before communication between that port and Boulogne would be established.

Then on 19th November, a meeting of the Wireless Telegraph and Signal Company, Limited, was held at the Cannon Street Hotel, at which Mr. Edgar Appleby presided. After a discussion about the recent experiments and suggested plans for future expansion, "satisfactory progress" was officially reported.

Definitely, then, with the passing of the year 1897, wireless telegraphy passed out of the experimental stage, that is to say, whatever experiments were to follow were for the extension and expansion of wireless telegraphy. Marconi's months in London had not been unproductive.

CHAPTER III

MARCONI AND QUEEN VICTORIA

As the success of Marconi's invention became more widely established, the commercial scope of this new means of telegraphy was emphasized, and progress became linked up with finance and company business. When Marconi returned to this country he found himself of no little importance as a figure-head among men of business. His time was fully occupied, and he was to learn that in his dealings with older men, whose wits had been sharpened by self-interest and whose consciences had been correspondingly blunted, the hard common sense he inherited from his father stood him in good stead.

Marconi has always been a sound man of affairs. It is recorded that from the earliest days of his activities in this country business men found in this reserved and handsome youth not—as they may have fondly expected—a dreamy inconsequential young inventor who had stumbled among his rainbows upon a crock of gold, but a youngster who knew what he was about, and one upon whom the blandishments of commercial usage were turned in vain.

Anyone who was expecting to make a quick fortune out of this young inventor's new idea soon lost his rash optimism. On the other hand, sound men of affairs with vision and the necessary facilities found in young Marconi an associate who could be trusted not only for his fair principles of business dealing, but for his ability for concentration and hard work. He was too shy in his younger days to be an outstanding social success, yet among older business associates he was always respected. It is to this rather strange fact—strange, considering his imaginative and romantic nature—that must be ascribed Marconi's notable immunity from serious mistakes.

For a young Italian, living in London, with (possibly) the greatest commercial invention the world had known at

his disposal, it is indeed surprising that in selling it to civilization through the devious channels of commerce he did not meet with more trouble and grief than he did. There was much to thank old Giuseppe for, impatient though he may have been over the rape of his terraces.

In the Press of the time Mr. Marconi's experiments were from time to time news. He was already a figure of whom the man in the street was conscious. Yet he lived still so much for his work and his ideas that it is not surprising that he made few intimate friends, or even acquaintances. He avoided hospitality, the companionship of his mother was sufficient, and within the stronghold of his *pension* he might as well have been living in China or South America.

His position in this country was an official compromise. Young Marconi should have been serving his country as an officer in either the Army or Navy. In the official journal published by the Italian War Office there is record of the questions of Marconi's military service. An article uses him as an argument directed against the stupidity of interrupting scientific research. When Marconi first became eligible for military service, although he was anxious to serve his country, as other young Italians did, he shrank from the idea of abandoning his experiments, even if only for a time. He took no steps in the matter himself; two men, both famous in different walks of life, were responsible for not robbing the scientific field of a most important asset. These were Lord Kelvin, the British scientist, and General Ferrero.

Urged by Lord Kelvin, the General wrote personally to the Italian Minister of Marine Affairs. In this letter he described some of the young man's activities at sea, beginning with the valuable work he had carried out from his fishing smack at Leghorn, and continuing by pointing out how his experiments would be delayed if he were called up for service.

The letter was received sympathetically and the outcome of the affair was Marconi's appointment as an assistant Marine Attaché to the Italian Embassy in London.

His duties were practically nominal, for it was understood by all concerned that he was to devote himself to his scientific work. His needs in London in those days were

extremely modest—he never went out into the social world—an occasional visit to a concert with his mother, and more rarely still a music-hall with some compatriot from the Embassy.

His allowance from home covered all that he needed for expenses, which accounts for the fact that Marconi still has uncashed the monthly cheques which were paid to him by the Embassy. It had been arranged by Marconi that these cheques, which had to be given to him as a matter of form, should never be cashed, and that the funds placed to clear them should be passed on to a charity. It is doubtful if anyone in London except those directly concerned ever knew where the money went.

Month by month (so show the records of the Italian Hospital, Queen's Square, Bloomsbury) amounts were paid to the hospital equal to the pay and allowances due to Marconi, but there was nothing to show who was the generous donor: he remained anonymous.

This episode is most characteristic of the methods used by Marconi throughout his life, when making charitable donations. He has always had a kind heart, too kind some of his friends say, but—be that as it may—it would be quite foreign to his nature to enjoy receiving thanks and public ovations. When he wishes to do a kind action, he plans that it shall remain anonymous.

His refusal to live a social life in those early days in London, or to be entertained by any but friends and relatives of his family, quite naturally induced certain people to take an added interest in him—and incidentally his work.

A leading Edwardian hostess of her day was later to remark: "A most odd and extraordinary young man" when referring to this young Anglo-Italian who definitely refused to be drawn into social range of the most exclusive drawing-room in London. It must be admitted that this celebrated figure was a little less wrong than usual in her remark. For here was a young man who could outdream a poet and yet cause business men of Scottish extraction to think twice and then take advice on the matter. A sailor who had no connection with the sea, an attaché whose duty it was to remain

unattached, and, moreover, a handsome and well-born Italian whose idea of romance was a pot of sal-ammoniac decorated with zinc.

Yet, in spite of his absorption in his work, young Mr. Marconi was on the way to becoming a public figure in London. The Victorian London of the day was constantly being surprised and gratified to learn that he had succeeded in sending a message here, or receiving one there. To the hundreds of thousands of radio listeners to-day, it must indeed sound strange to learn that the first objection made to the use of wireless telegraphy was its lack of secrecy. Messages sent out could be received by anyone, it was said. Following his first success, Marconi devoted himself to developing tuning apparatus, which led to the discovery that stations could be adjusted to receive only waves of a certain length.

Thus it was ascertained that a message would be received at the place it was intended for. Whilst Marconi was working in London, Preece continued to supervise experiments that were being made in Dover. Here the authorities were endeavouring to get as good results as Marconi, but scarcely succeeding. Each day all the instruments were carefully taken to and from Fort Burgoyne, guarded by a body of official workers. The utmost secrecy was used. People in the neighbourhood were intrigued by the high mast, and crowds would collect at times and gaze upwards especially when, in order to try what additional height would do, a flying kite was used, attached to a wire.

Although 1898 was not as adventurous a year as those which followed, some interesting events took place which added both to the scope of wireless, and to the prestige of its young inventor. Lloyd's Corporation, for example, saw the possibilities of the invention in connection with lighthouse work, and at their request an apparatus was installed at Ballycastle and Rathlin Island, in the North of Ireland. The lighthouse keepers were not long in learning how to operate the new invention, and constant communication was set up.

Naturally, with his mother's connections, there was keen interest taken in Marconi's achievements all over Ireland, and it is interesting to recall that the first commercial use of

wireless took place in that country. An Irish newspaper, the *Dublin Express*, may be described as the first to use wireless as a conveyer of news. This newspaper asked Marconi to report the events of the Kingston Regatta for them, which he agreed to do.

The tug *Flying Huntress* was equipped with wireless apparatus, and, with Marconi on board, it followed the yachts in the Irish Sea. A land-station to receive the messages had been erected at Kingston, whence they were relayed by telephone to Dublin. This took place in July, 1898, and certainly marked an epoch. Of this entirely successful venture, Marconi has said, "It opened the eyes of a great many people to the commercial possibilities of wireless. Previously it had been the more scientifically-minded who were interested. Now, the man in the street began to wonder whether this wireless might not be of use to him."

It was also about this time that Lord Kelvin visited the station at Alum Bay. He had a great respect for the achievements of the young inventor, and he was so delighted with what he saw at Alum Bay that he sent telegrams to many of his friends, including Preece. This un-English enthusiasm, coming from so distinguished a source, caused in its way, a mild sensation. The Italian Ambassador, not to be outdone, visited the station the following day, and sent a long telegram to the King of Italy's first aide-de-camp. The first Press venture showed, in truth, that to gain recognition it is necessary to get at the man in the street.

Many of the world's scientists were interested in Marconi's experiments, and (as one would expect), some had hostile criticisms to make and theories of their own to advance. Marconi never resented criticism and he was always anxious to meet all who were really interested in his work and its future. "I was," he has said, "only too anxious to welcome any way in which people might be made more alive to the great possibilities of wireless communications."

In April, 1898, Professor Silvanus P. Thompson read a paper before the Royal Society of Arts on the subject of "Telegraphy Across Space." He said: "Actually there is no wireless telegraphy, for wires have to be used at the base." He followed this enlightening preface by a statement,

equally uncompromising, that he thought it possible to develop induction and conduction methods so that in time they could communicate with the Cape and other far-off places, at less cost than by submarine cable. But he was doubtful if the wave method would prove practical because of the earth's curvature.

April, May, and the following months of 1898 were particularly interesting on the Solent. The 120-foot mast at Alum Bay from which depended the metallic conductor, was an object of consuming interest to daily crowds of sight-seers. Fables grew around that mast, and of its day it must have been the most talked-of object in the country. The privileged few could witness inside the sheds further sights bordering upon black magic. An induction coil could be made in the darkness to give off a spark eight to ten inches long! And with it came a hissing, crackling sound only to be associated with demoniac activity. At the same time holiday visitors at Bournemouth stood awed and confounded by similar apparatus which stood just opposite the end of the pier.

In speaking of those days, Marconi recalls that he had the greatest difficulty in convincing people that rain and fog would not affect his messages, which fact helps in some measure to arrive at an appreciation of the state of the popular mind. For the vast majority wireless telegraphy was a complete and absolute mystery. There were no standards by which to measure this new wonder. It was the first contact between Victorian England and a power that could neither be seen nor heard, but which submitted itself to the control of men. In those more secure days, men were not so ready, as they are in 1935, to seize upon the latest invention in the hope that it will yield them a rapid profit. Life was lived more leisurely and new innovations had to prove their worth before they were welcomed into the lives of the people.

With all this pole-gazing going on among her loyal subjects, no further away than Alum Bay, it was obvious that Queen Victoria, in residence at Osborne House, should hear of it. Young Mr. Marconi's experiments, particularly those long, licking sparks, that hissed like a serpent enraged—

were already the subject of much speculation among Her Majesty's entourage.

On one occasion, an afternoon which must have been sunny, for parasols were used, Royalty itself turned a head to look at a distant mast, then to ask questions of an equerry who seemed to be singularly poorly informed.

What further steps Her Majesty might have taken in order to learn more of these Isle of Wight experiments, must be left to conjecture, for circumstances introduced the use of wireless to the Queen in quite an unexpected manner.

It happened thus. The Prince of Wales (later Edward VII) injured his knee and was obliged to remain aboard the Royal Yacht *Osborne*. Having noted the successful manner in which messages had been exchanged with ships, a member of the Royal Household suggested that wireless might be installed upon the Royal Yacht. Whether it was the Prince of Wales or Queen Victoria who made the final decision in unknown, but Marconi says:

"Almost immediately after finishing the experiments at Kingstown, I had the honour of being asked to install wireless telegraph communication with the Royal Yacht *Osborne* and Osborne House (I.O.W.), in order that Her Majesty the Queen might communicate with H.R.H. the Prince of Wales from Osborne House to the Royal Yacht in Cowes Bay, and during the trips which the Prince frequently took.

"For many reasons the working of this installation was a very pleasant experience for me, and afforded also an opportunity of studying more thoroughly the effect of intervening hills. Induction coils capable of giving a 10-inch spark were used at both stations. The height of the pole supporting the vertical conductor was 100 feet at Osborne House. On the Royal Yacht, the top of our conductor was suspended to the main mast, at a height of 83 feet from the deck, the conductor being very near one of the funnels and in the proximity of a large number of wire stays. The vertical conductor consisted of 7-20 stranded wire at each station.

"The Royal Yacht was moored in Cowes Bay 1¾ miles from Osborne House, as the two spots were not in sight of



THE VILLA GRIFFONE

each other (the hills behind East Cowes intervening), direct signalling by means of flags or semaphore system would have been impossible.

"Constant and uninterrupted communication was maintained between the yacht and Osborne House during the 16 days the system was in use, no hitch whatever occurring."

One hundred and fifty messages, which were chiefly private communications between the Prince and his mother, were sent, and many of these bulletins contained over a hundred and fifty words, the average speed of transmission was about fifteen words a minute.

The Times reported the proceedings and the messages which were sent from day to day. On 4th August, 1898, *The Times* printed the following message despatched between the yacht and Osborne House:

From Dr. Fripp to Sir James Reid.

H.R.H. the Prince of Wales has passed another good night and is in very good spirits and health. The knee is most satisfactory.

Again on 5th August:

H.R.H. the Prince of Wales has passed another good night and the knee is in good condition.

Similar messages continued each day until 10th August when the Prince had almost recovered, and the yacht was under way:

From H.R.H. the Prince of Wales to the Duke of Connaught.

Will be pleased to see you on board any time this afternoon when the Osborne returns.

This last message was sent when the yacht was off Bembridge at a distance of about seven or eight miles from Osborne.

The inventor was on board on the occasion of several trips which followed, and he has vivid memories of the keen interest which the Prince took in the experiments. He

shared Marconi's conviction that wireless had a great future.

On 12th August the *Osborne* steamed to the Needles and communication was kept up with Osborne House until off Newton Bay, a distance of 7 miles, the two positions being completely screened from one another by the intervening hills. From this position also, it was found quite possible to speak to the station at Alum Bay, although Headon Hill, Golden Hill, and over five miles of land lay in between. Headon Hill was 45 feet higher than the top of the conductor at Alum Bay station, and 314 feet higher than the vertical wire on the *Osborne*.

On the same trip the yacht travelled about three miles past the Needles, and communications were kept up all the time.

"The Duke of York and other members of the Royal family, as well as the Prince of Wales, made use of the system, and they were all highly satisfied with its practicability," Marconi says, when he describes how one of his happiest memories was his meeting with the aged Queen. It was after he had installed his apparatus on the Royal Yacht, that he was invited to visit Osborne House, as an audience with the Queen would be granted to him.

The Queen expressed her pleasure at meeting the young man, and told him how much the Prince of Wales had already explained to her about the experiments which had been carried out.

She had read, the inventor learned, during the course of conversation, of the works of Onesti and Professor Branly and was much interested in the possibilities of electrical waves in the future.

There were other questions of a more personal nature; how long was he going to remain in England; what experiments did he intend to carry out next?

"I congratulate you, and hope you will have many further successes," said the Queen kindly to the young man.

When Marconi read a paper at a meeting of the Institution of Electrical Engineers the following spring (2nd March, 1899), he fully described the experiments which had taken

place on the Royal Yacht. . . . "Also the Prince of Wales permitted me to have all the messages which had been sent, so that I could read any of them,"—adds Marconi describing the event.

These messages attracted a good deal of popular attention, and opened the eyes of the public to possibilities hitherto unthought of. But on 3rd March, 1899, a striking indication of the use of wireless telegraphy in the good of the community was given. For the first time on that date, life was saved by wireless.

A steamer was stranded on the Goodwin Sands. The East Goodwin lightship at once reported it to the South Foreland lighthouse by means of wireless apparatus. Lifeboats put out at once, and the entire crew was saved, and even if this in itself were not a matter of sufficient importance, there was in addition the saving of £52,588 worth of property.

Some months later there was another similar occurrence when the steamship *R. F. Matthews* (1,964 tons gross burden), outward bound from the Port of London, came into collision with a Channel lightship. On this occasion a wireless message was picked up by one of Marconi's principal assistants—Bullock. This wireless message from the lightship was promptly relayed by Bullock to Trinity House at Ramsgate. The alertness of Marconi's assistant aroused much enthusiasm and many favourable comments were made in the Press, not only about the particular wireless installation, thus "made news," but about wireless in general.

In September, 1899, while Marconi was staying at the Needles Hotel, Isle of Wight, some changes were made in local wireless stations. The experimental station at Madeira House, Bournemouth, was transferred to the Haven Hotel, Poole; in after years this hotel became an historic "wireless" landmark. About the same time the Alum Bay station was transferred to St. Catherine's Point, I.O.W. The people of this island took a great interest in wireless and to-day are still proud of the fact that local stations played so prominent a part in the pioneer stage of the invention.

The principal interest in wireless just at that particular time seems to have been chiefly concerned with experiments at sea and from ship to ship. During the Naval manœuvres,

for instance, in 1898, communications between warships were carried out at a distance of seventy-four miles. Three ships of the B. Fleet were fitted with wireless installations, the flagship *Alexandra* and the cruisers *Juno* and *Europa*. Marconi himself was aboard the *Juno* with his friend Captain Jackson, R.N., who had already done some good work in the cause of wireless telegraphy. At the conclusion of the manœuvres, victory was gained by the B. Fleet, and Admiral Sir Henry Compton Domville attributed no small measure of this success to wireless, which he found "equally efficient in all weathers." The fact that wireless was not affected by storms or rain was one of the chief wonders to the average mind in those days; it was difficult indeed to impress people that they could not expect better results just because the sun was shining.

The next wireless step was across the Channel. Negotiations had been in train for some time with the French Government with a view to establishing a station at Calais and later at Cherbourg. After a good deal of prospecting on the part of the interested parties, the Chalet L'Artois was chosen at Wimereux, a village on the French coast, three miles north of Boulogne.

"I walked it often enough," Marconi relates. "It was pleasant enough on fine days, and one might easily be forgiven for underestimating the distance, but when there was a gale, and the rain came down in torrents, as it did on many occasions during my stay in the district, it was not possible to underestimate the three miles."

Marconi had no doubts whatever as to the success of the proposed communications across the English Channel, and of course he went personally to conduct the earliest experiments. With the aid of only three engineers, he saw to the establishment and adjustment of all the necessary apparatus. No task was too big for him to tackle personally, if there was need for it—and no detail was too trivial.

It was a matter of no little astonishment to the French officials who visited the station from time to time, whilst it was in the process of being properly equipped, to find that the inventor himself cheerfully worked as an engineer,

a mechanic, an electrician, a builder's labourer, or anything else that the moment demanded. The memory of the gardens at the Villa Griffone was close behind Marconi, the smell of the earth turned under his spade, the wet branches of the chestnut-trees. There he had done everything for himself, and he knew that it had all been well done. In the recipe for success which followed him throughout his life, Marconi's insistence on working at a job himself, whether it be detailed planning or on a grand scale—this must surely be one of the ingredients. As his various experiments developed, of course, the complicated nature of them made it impossible for him to carry out everything personally, and then the loyalty of those he had trained stood him in such good stead.

The first message across the Channel was in March, 1899. The distance was thirty-two miles, from Wimereux to South Foreland. The first Press message, as reported in *The Times*, was sent on 28th March in Morse code.

As Marconi was most anxious that members of the French Government should be perfectly satisfied, a number of French officers were present at Wimereux on 28th March. Captain Ferrer represented the French Government; not only was he intensely interested, but that interest was maintained, for in later years he played an important part in the "wireless" world, and later, during the War, he was responsible for many important installations and communications. Mons. Voisenant was sent by the French Telegraph Service, Col. du Pontavice, French Military Attaché, and Commandant Fieron, Naval Attaché in London, completed the party. Marconi, however, was not content that they should only witness messages from England. He wanted them to be present when the experiment was reversed. With this object in view the party left by the night boat from Boulogne.

Marconi was well satisfied with the way in which the cross-Channel message had been transmitted. "I remember," he states, "that my friend, Professor Fleming, was so much interested that I decided to send him a message." Professor Fleming in due course received at University College, London, the following message:

Glad to send you greetings conveyed by electric waves through the ether, from Boulogne to South Foreland, and thence by postal telegrams. Marconi.

Marconi had received permission from the Trinity House Brethren to make use of their accommodation, and the French officials were taken by the inventor to a little room in front of the engine-house, at the South Foreland lighthouse. The good weather which had accompanied the experiments at Wimereux the previous day did not follow them to England. The Frenchmen were rather worried, although Marconi assured them that bad weather would make no difference. His statement was met with suspicion, but the tape tapped happily and all again was well. The following message was sent:

Delègues commission française d'experience telegraphie sans fils à Ministre Guerre, Marine, et Commerce Paris. Delègues et Marconi ont L'honneur vous addresser d'Angleterre première depêches travers Manche. Appareil fonctionne regulièrement, Fieron, Du Pontavice, Ferrier, Marconi, et Bullock.

After this event Marconi returned to Wimereux, where for a time he contrived to live the simple life, which he has, in fact, at all times preferred.

Many people visited him there, among them General Baden Powell, who was so impressed with what he saw that he wrote to *The Times* urging the adoption of wireless telegraphy both in peace and war. During the four days of Lord Baden Powell's visit to Telegraph House at Wimereux, Marconi, demonstrating his invention, not without pride, to this famous soldier, attempted communication with South Foreland. It was ten o'clock at night, and on sending out signals Marconi got no reply. After an interval they tried again, still without result. Very carefully then he examined the connections, and chagrined, went over the complete apparatus. He sent out signals again and finally installed a new receiving set. Baden Powell was sympathetic, and well might he have been, for the night was dark and stormy—not the kind of night to remain out of doors—even for a Scout.

Together they braved the cold rain, pulling at the vertical wires, tapping the mast and barking their shins, unable, of course, to see the top of the mast in the blackness of the night.

Sympathy was not the stuff to which Marconi was accustomed, and frankly this utter silence from the other end puzzled him. The expression on his face grew more and more grim with the passing minutes, and tension affected the hero of Mafeking, used as he was to tight corners and tight belts. Baden Powell began to feel a trifle jumpy too. Had the great scientific principles behind wireless telegraphy suddenly changed? Surely it was unbelievable that the system had broken down? Baden Powell saw that this was more than broken wireless apparatus to Marconi. It was a shattered faith.

Suddenly, in the shed behind the bell rang, and at its insistent clamour the inventor leapt like a scalded cat.

"*South Foreland!*" yelled a mechanic.

South Foreland it was; a message was coming through. Holding the lamp close, Baden Powell read over Marconi's tense shoulder:

Just back from supper anything happening your end?

CHAPTER IV

THE ATLANTIC IS CROSSED

THE close of the nineteenth century was marked by strides of progress in many fields of invention. The vast improvements in transport and communication from the railway to the telephone were undoubtedly the outstanding features of this century, now so nearly complete.

The birth of the twentieth century was the birth of the new Scientific Age, the wonders of which are by no means completed yet. Before 1900 dawned wireless might be said to have passed from the narrower European field of experiment to world-wide significance.

The summer of 1899 saw the cruise, in the English Channel, of the despatch-steamer *Ibis* with tests and experiments that proved beyond all reasonable doubt that the invention had possibilities for communication with ships at sea. Most of the time a delegation from the French Government was aboard the *Ibis* and official messages were sent to Paris and to the French Ambassador in London. It was as a direct result of these demonstrations of efficiency, that the French Government drafted a report recommending that communication between Newhaven and Dieppe should be set up at the earliest date possible.

Marconi was on the *Ibis* all the time and he had with him as his assistants J. S. Kemp and W. S. Bradfield. Bullock remained at the South Foreland in order to see that everything was carried out there with the utmost care and precision.

Though only twenty-five years old, Marconi's name was becoming famous throughout the world and visitors and letters came from all quarters to inquire into the activities of this young Italian.

On 7th April, 1899, Doctor Cockburn, Agent-General

for South Australia, was sent by his government to South Foreland to inspect the installation there, and he witnessed the sending and receiving of messages in a raging gale of wind and rain—the sort of weather that Marconi and his assistants had by now begun to expect whenever official visits were due. Mr. G. Bullock, one of the staunchest of Marconi's assistants, who was (as already noted) in charge of the South Foreland station, was for years unable to think of distinguished visitors without associating the spectacle of their visit with flying bowler hats and umbrellas turned inside out.

A deputation of the Amazonian Telegraph Company of Brazil provided the inventor with a language problem which was scarcely helped by the deafening east wind, howling through the anchored wires of the masts, and thunder-showers that made Amazonian silk hats hardly worth the chasing, when they bowled merrily across the sodden turf.

Among the visitors who were welcomed that stormy April, was the Secretary of the Post Office, who watched with great interest (and a cloth cap) a message from the French station come in.

On 15th April, the President of the Board of Trade, Mr. Ritchie, made an official call and was entertained in the shelter of the little hut on the top of the cliffs.

Those were busy days from the diplomatic point of view, and though they may not have seemed very important at the time, they left an impression which in many cases was the foundation for future agreements of world-wide importance.

Reception plans in the hut were the cause for no little concern. Though amply equipped and suitable for the purpose of experiments, it was not meant as a reception-hall for diplomatic entertaining. Quite often when the lights were turned on and the stormy darkness outside forgotten, feet would be comfortably set on the table, the stove aglow and pipes lit. The case of bottled beer lay easily to hand. Wisdom in all things is only gained by long experience, but it was found that the provision of umbrellas, cigars, and bottled beer was a pretty good means of meeting this impromptu problem.

Even when Marconi was absent for a day or so, these visitors did not cease, which accounts for the fact that Mr. Bullock had to entertain the Chinese Minister, Sir Cheil Chen Lo Feng Lu, who had journeyed from London, to see something of the wonder about which he had heard so much. It is clearly on record that the Minister was deeply impressed with all he saw. His questions were many and varied. Heavy rain marked the occasion of this visit, so say the current reports.

Those people who found Marconi a little difficult to know in those days would have seen a different man altogether had they been able to see him with his assistants, notably, Kemp, Bullock and Bradfield. They saw another side to his character. Here were the companions in the labour that absorbed his life, and he was the best and most amusing of companions. There was little of the reserved, almost supercilious young man to be noticed when sleeves were rolled up, and as likely as not graphite and rubber solution decorated the face.

At this time a labourer hired to do such heavy work as could not be conveniently managed by Marconi and the others, was sharply called to order by Bullock one morning on the grounds that this man was understood to have referred to Marconi as a "bit queer."

The labourer lived at the station, and as there had been, inevitably, talk of this nature in the neighbourhood, feeling ran rather high. Marconi inspired then, as he had always done, an almost fanatical spirit of loyalty among his intimates. The argument might have ended in more than a scuffle, when the subject of the altercation himself appeared on the scene.

There was some diffidence about explaining the *causus belli*, when the dust had settled and coats were adjusted correctly once more, but the chief always insisted upon knowing when anything was wrong, and saw no reason why this occasion should be an exception.

"It's like this, sir," explained a local man who was employed to rig the masts. "This bloke says you pay him to do a job of work, and he has his tools to get on with it. Then you start to show him just how it should be done,

and often you get so interested that you finish the job yourself, with him just looking on."

This explanation rather puzzled Marconi, until the man added: "Even if it rains you don't seem to mind, and he thinks only a man who was a bit queer would behave like that."

Marconi remained thoughtful for a moment, then he smiled, and his smile usually clears away difficulties; it did this time.

When Bullock moved from that station at South Foreland to take charge of construction at another station, the labourer moved his home to keep with the outfit, and he was still employed by the company, according to the records, in 1908.

In August letters began to appear in *The Times* on the subject of wireless telegraphy and naval warfare, to be followed by Mr. Chas. A. Kent, writing on behalf of the Trinity Elder Brethren, warmly refuting a charge that the Trinity Brethren had been a long time in adopting and welcoming the new invention. *The Times* was indeed taking notice now and young Mr. Marconi was constantly in the news.

On 2nd February, 1900, Marconi gave an address at the Royal Institute of Great Britain, which was attended by, among others, Alexander Siemens, Lord Rosse, Lord Rayleigh, Sir Frederick Abel, Sir Frederick Pollock, Sir Frederick Bramwell, Sir James Creighton Brown, Sir Alexander Binnie, Sir Dyce Duckworth, Professor Dewar, Major Flood Page, and Doctor J. H. Gladstone.

This meeting was a tribute to the young inventor which he did not fail to appreciate. At the time, however, he felt nervous enough and wished himself miles away in the hut on the cliff-top.

In October, 1899, the Boer War had broken out—when the Boers invaded Natal. As most people will remember, the early days of the war were marked by reverses for the British; this fact and others made people ask if the new invention would not be of some use in South Africa.

With such ideas in view, the inventor was approached; Marconi, as he always proved to be in later years, was extremely anxious to do all he could to assist the British

Government. As usual in such circumstances, there was a good deal of discussion; finally, in the beginning of 1900, it was decided that some wireless engineers should be sent. Marconi, of course, conferred with his assistants, and as a result, his chief operator, Mr. Bullock, and five others, among them Mr. F. S. Franklin, were sent out to the Cape.

Results at first were by no means as good as they should have been, actually because the facilities offered were so much against them. They had to work without poles, using kites, and there were other difficulties; even the type of country was entirely different geographically from any district where wireless experiments had been carried out.

The little body of Marconi men showed great fortitude and overcame all manner of obstacles, often showing initiative little short of heroic. Later, conditions improved, but on the whole results were not impressive.

There was, however, one extremely interesting side issue connected with the war and Marconi himself.

Early in the year 1900 he went to America and, after a brief visit, returned to England in the American liner *St. Paul*. He had given a most satisfactory demonstration to the United States Navy during his visit and returned ready to conquer fresh fields.

Aboard the *St. Paul* it was suggested that as there was a permanent station at the Needles, I.O.W., Marconi might fit up his instruments in the liner, and obtain the latest news about the war for the passengers whilst at sea. Marconi readily consented to do this and installed his apparatus. He successfully got into communication with the Needles station from a distance of 66 nautical miles; then, with the *St. Paul* steaming at 20 knots, messages were despatched by passengers on board.

Some quite important news about the war was received and printed in a small paper, which was called the *Transatlantic Times*. This is the first occasion of news being received by passengers at sea. Marconi recalls how every morning groups of passengers could be seen standing about waiting anxiously for these novel bulletins. The appearance of the inventor on deck, always aroused keen interest. "I was asked all kinds of questions," admits Marconi, "many

intelligent and some very foolish, I am afraid. Anyway, no newspaper proprietor ever had his news more enthusiastically received than I did."

Telegraphy over long distances was talked about quite openly at the beginning of the twentieth century; people who foresaw great possibilities in Marconi's invention had in many instances been afraid to prophesy too much for fear of ridicule, but the unbelievers were slowly becoming believers.

In a lecture given at Bari, in Italy, in May, 1900, Signor Guarini, who invented an automatic repeater by means of which messages could be passed from one station to another, said he was convinced that messages could be sent for about 500 miles. His audience were much impressed by his statement, actually it was not an impressive one, for Marconi at that time had much greater hopes. The difference was, of course, that whereas Guarini was pleased to proclaim his ideas, Marconi kept his to himself. He has always been a most difficult man to extract a prophesy from, and more particularly when that prophesy concerned his work.

On 5th November, 1900, there was a demonstration of the use of wireless on mail-steamers. This was carried out between Dover and Ostend. A land installation had been set up at a place called La Panne, between Ostend and Dunkirk. At two o'clock in the afternoon the S.S. *Princess Clementine*, when in sight of Dover, sent a message which was promptly received at Ostend. It may be of interest to some people to know that this mail-boat, which for a number of years plied between Dover and Ostend, and was of the old "paddle" type, ended her days carrying troops during the Great War.

Almost at the same time Colonel Hozier (whose daughter is now Mrs. Winston Churchill), Secretary of Lloyd's, on behalf of Lloyd's, notified Glasgow shipowners that it had been decided at their recent meeting to establish a station at Inishtrahull in Northern Ireland, for receiving reports from vessels by etheric signals.

Also during 1900 many improvements embodied in patents taken out by Marconi were utilized. On 26th April

he applied for a patent for "tuned or syntonic telegraphy as well as multiplex telegraphy with a single aerial." The important novelty was the incorporation of tuned close, with tuned open circuits in both the transmitter and receiver. The number of this patent was 7777, which later became famous in the history of wireless, its validity being upheld in the High Court by a decision of Mr. Justice Parker.

By this year also the technical staff of the Wireless Company numbered seventeen and included W. W. Bradfield (late General Manager and Director of Marconi's Wireless Telegraph Company and of the Marconi International Marine Communications Co., Ltd.). Professor Fleming, F.R.S., of the University College, London, had been appointed scientific adviser to the Company a year earlier. He had had great experience in electrical engineering, especially lighting work and high tension and alternating currents. Also he was keenly alive to the possibilities of wireless and had already expressed optimistic views concerning it.

Ever since Marconi had bridged the English Channel, linking the English and French coasts by wireless, his mind had been intent upon a much greater achievement. This time his ambition was, not to cross a sea—but a mighty ocean.

Often when at sea his companions would notice his blue eyes gazing steadily across the vast expanse of Atlantic rollers. Had they been able to read his thoughts, they would have found them centred upon one ambition—to send a message, which would not only link up millions of English-speaking people, but connect two continents.

Before beginning his transatlantic experiments, Marconi felt it was imperative that he should find an isolated spot for the powerful station which he had planned should be built on the English coast for this tremendous experiment; in an isolated position the waves would have a better start. Dr. Fleming had been asked by Marconi to work out all the details of the power plant required, and to design the high voltage condensers for the installation.

In July, 1900, Marconi, accompanied by Major Flood Page (now Managing Director of the Wireless Company), and Mr. R. N. Vyvyan (an engineer, who was to take charge

of the construction of this station), visited Cornwall. He was anxious to find a site which would be isolated without being too remote, with a clear passage free from obstacles, across the ocean. Finally a site was selected at Poldhu, near Mullion, situated north of the Lizard. It is doubtful if the men who worked so enthusiastically erecting this station ever realized that for more than thirty years it would play a great part in the history and development of wireless.

Apart from the possibilities of the site, few people, and certainly not Marconi, could have been insensible to this piece of real Cornish scenery, with its rugged coast of golden rocks, which jutted out into the sea, jagged like the teeth of some mighty prehistoric monster. Dark shadows on the blueness of the sea betrayed the presence of submerged rocks responsible for more than one ship's foundering. On a stormy day when the scene of beauty could be changed to one which would inspire awe into the stoutest heart, blackened skies would reflect their darkness on the sea and rocks.

In the spring the cliffs were bright with sea pinks. Higher on the grassy reaches the gorse was seldom entirely out of bloom. A few tiny blossoms would remain as a reminder of the honey-perfumed golden beauty to come.

Marconi had calculated that in order to send a message across the Atlantic he would require a capacity of 1-50 of a microfad discharging across a 2-inch spark gap. It was a great problem to obtain this by the single action of a transformer on a condenser, without raising the transformer voltage to an unworkable value. It was Dr. Fleming, however, who devised a method of double transformation, whereby the current from the transformer was employed to charge a condenser, discharging through an oscillation transformer across a spark gap. The secondary of the transformer, consisting of more turns than the primary, was connected to a second spark gap; a second condenser and the primary winding of a second oscillation transformer being also across the spark gap. The secondary of the last transformer was in series with the aerial.

Proper syntonization is absolutely necessary for the effective working of this arrangement, but the principles of

syntonization were by this time thoroughly understood, chiefly as the result of Marconi's work on this subject. During January, 1901, the Poldhu station was completed and the plant installed and ready for testing.

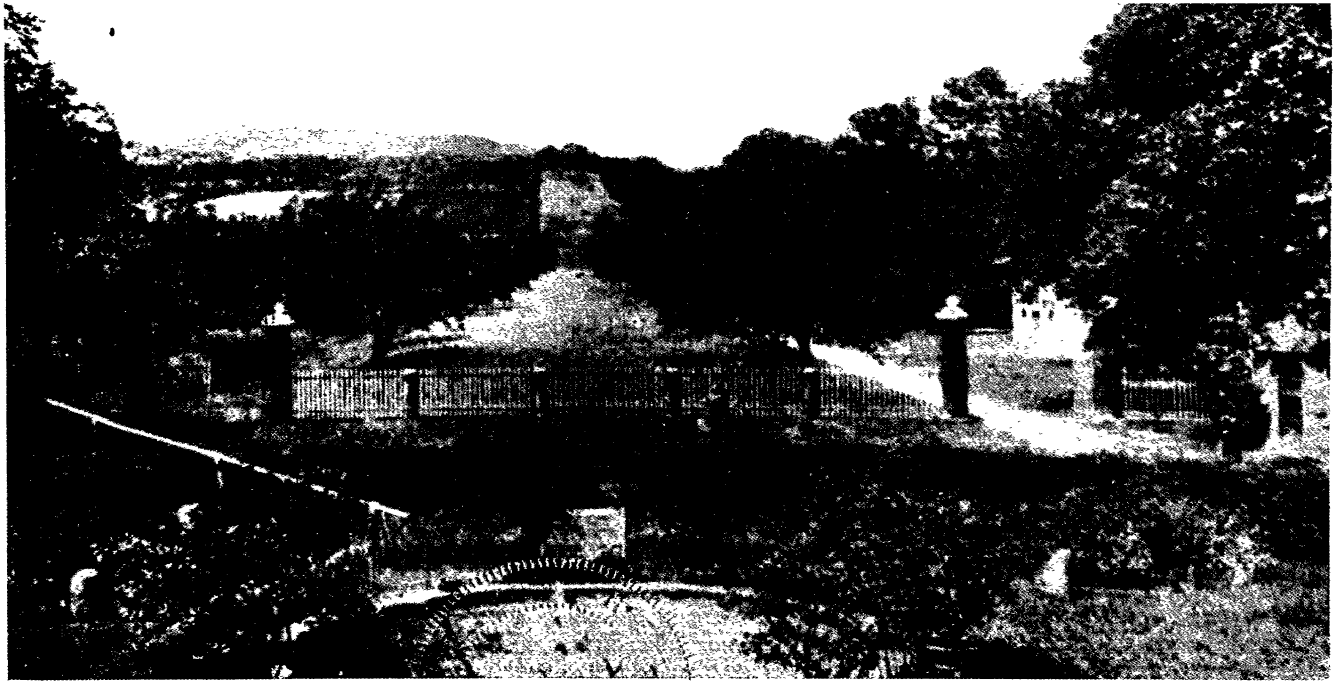
Marconi was consumed with impatience, so anxious was he to attempt the Atlantic test. "I really had no doubts about the ultimate success of the experiment," he said at the time, "but I was anxious to refute as soon as possible the scepticism which surrounded me." Dr. Fleming arrived at the station on 22nd January and most careful tests were carried out by him and the inventor.

Just before Easter, 1901, the first message was sent from the new Poldhu station to the Lizard, some six miles distant. During the following months Marconi made great improvements in the design of the oscillation transformers, for these had not hitherto satisfied him. Then further tests were made by sending messages to the Isle of Wight, and later transmissions were sent over a distance of more than 200 miles. He was satisfied at length and turned his mind towards his departure to Newfoundland, where a station had been erected at St. John.

Elaborate and methodical preparations were made for the departure, owing to the wintry conditions which were sure to prevail at that time of the year, and the shortness of time at his disposal, Marconi had decided to use emergency kite-supported aerials.

However, this packing was finally completed, yet when the hour for leaving came, incredibly, Kemp was not to be seen. Carefully laid plans were in danger; there were prospects of missed trains and boats looming ahead, when Kemp panted into sight of the sheds. It could be seen that he was labouring under the weight of a heavy and bulky package. A puzzled frown knit Marconi's brow. Was this some equipment which had been shamefully forgotten? It was half a dozen bottles of whisky, which had taken a little trouble to obtain; but the faithful Kemp had heard talk of fogs and rain in Newfoundland: he had brought the best protection he could for his chief—at least that is what he thought.

They caught the boat, however, for it is recorded that



THE GROUNDS OF THE VILLA GRIFFONE AT PONTECCHIO. SCENE OF THE FIRST OUT-OF-DOORS WIRELESS EXPERIMENTS

on 26th November, 1901, Marconi, accompanied by J. S. Kemp and P. W. Paget, sailed from Liverpool to Newfoundland in the S.S. *Sardinian*, arriving at St. John's on 6th December, having with them two balloons and six kites for the purpose of elevating and supporting the receiving aerial. The intention being to use the balloons if conditions were favourable, and kites if there was very much wind. The advantage of balloons used in still weather would be that the aerial could be supported almost vertically and if necessary multiple wires could be employed; whereas with kites flown in the wind, the aerial would be suspended at an angle, and it would be difficult to use more than one aerial wire.

After examining the various sites available at St. John's, it had been decided that the most suitable would be the one on Signal Hill, overlooking the Port, where there was a small plateau of about two acres, which would be suitable for manipulating the kites and balloons. Close to the Cabot Tower was an old military barracks then used as a hospital, in which Marconi set up his apparatus, in preparation for the great experiment.

On Monday, 9th December, barely three days after the party's arrival, the preliminary work had been carried out on Signal Hill. The necessary earths were laid, the kites and balloons prepared, and the receiving station set up.

On Tuesday, 10th December, Marconi flew a kite with 600 feet of antenna wire as a preliminary test. On Wednesday, one of the small balloons was inflated and made its first ascent during the morning. The diameter of the balloon was about 14 feet, and it contained some thousand cubic feet of hydrogen, sufficient to hold up the aerial which consisted of wire weighing about 10 lbs. Owing, however, to the heavy wind that was blowing at the time, the balloon soon broke away, and disappeared in the heavy mist.

Marconi came to the conclusion that in such weather kites would probably answer the purpose better, and so on Thursday morning, 12th December, in spite of the gale that was blowing, he managed to fly a kite to the height of about 400 feet.

In describing the anxious experiments which followed his arrival at St. John's, Marconi said: "Signal Hill stood

high above a plain. The cold and damp was intense, and from the hour of our arrival the wind seemed to increase in strength. This did not worry me or my assistants, we had come prepared for such conditions, though naturally hoping for better ones. There was one thing to be thankful for, the transmission of signals would not be affected by the weather, but the continuous wind and rain made the task of erecting the necessary apparatus very difficult indeed. Progress had literally to be made by inches. With the kite rising and falling with the gale, it was impossible to use any form of syntonic apparatus. Therefore we used a highly sensitive receiver, in which mercury was employed, simply connected in series with a telephone receiver, attached to a battery and the aerial.

"Despite the opposition which I had received from many quarters, often that of most eminent men, it was still my opinion that electric waves would not be stopped by the curvature of the earth, and therefore could be made to travel any distance, separating any two places on our planet. From the very first of my experiments, I was sincerely convinced of this."

His faith was to be rewarded, but to anyone not possessed of his capacity to believe, those anxious hours on Signal Hill would have been a sore test. On the historic Thursday morning the kite overhead was bucketing and dancing like a thing possessed in the thick rain-spattered gale. Outside the station it was only with difficulty that a man could hold himself upright, against the wind. Hands were numbed, for the rain was petrifying in its intense iciness—such rain would have been bad enough if it had fallen in a steady shower, but it was swirled by the force of the gale, often lashing the men's faces like a whip. It was this gustiness that accounted for clothing soaked like rags, despite the fact that all were wearing seamen's boots and heavy fur coats. The little pot stove inside the station was festooned with clothing, which from time to time Kemp attempted to dry. Meals all that day, from the early hours, had been sketchy. A pot of cocoa stood on the hob, and the Scotch whisky had been broached. Outside the hut was a screeching pandemonium of wind and rain. Inside the noise was still deafening,

as the wind tore at the sheet-iron roof, and the rain-drops rattled upon it as if they had been steel filings. Again around the log walls the wind howled—nowhere was there any peace. Backwards and forwards to the masts and that tugging kite, Marconi fought his way, and each time he returned, it was to fix the man with the earphone anxiously. As midday approached, the rain cleared away, and the sky became brighter, but this appearance of improvement did not change the wind, which never seemed to diminish in force for one moment and, in fact, did not do so for many days afterwards.

It was impossible for Marconi not to feel worried; the storm he knew would not affect his transmission. At least that was his firm theory, and so far he had been right in the majority of his convictions. There was just that doubt about the curvature of the earth. Many men of science with achievements of importance to their names, had firmly stated that this curvature rendered signals by wireless impossible over a long distance. Could they be right?

Few words were spoken between Marconi and his assistants, or for that matter between anyone; first of all there would have been the difficulty of making a voice heard against the roar of the elements, and all were feeling anxious and strung up, though they would not have admitted such a thing had they been asked.

According to the instructions which Marconi had cabled to Poldhu, several days after his arrival in Newfoundland, signals were to be sent from the Cornish station between 12 noon and 3 p.m. (Newfoundland time), so nerves became more tense as midday approached. Also, work had been begun at an early hour in the morning, and the demands of the inner man were making themselves felt in everyone. There was a unanimous sniff of approval when the fragrant aroma of cocoa arose from the stove and Kemp filled a mug with the steaming liquid, adding a generous (and secret) nip of whisky.

The young Italian accepted and drank a cup of cocoa himself as he sat on a packing-case, tugging at the wet scarf which clung to his neck; anxiously his blue eyes sought the clock that hung on the wall—12.20. How long would the signals be now? One of his assistants passed him a plate

of sliced bread, with a slab of cheese on each slice. With a nod of thanks he took one and ate it in silence—then he crossed the room and took over the task of listening.

It was about 12.30 when the efforts of Marconi and his little party were rewarded by the receipt of a succession of three faint clicks in the telephone. The letter "S" had been chosen because it was so easy to transmit, and with the primitive apparatus then installed at Poldhu Marconi was afraid that the transmission of Morse signals which included dashes, might perhaps put too much strain on it and break it down. Listening intently Marconi heard those signals for some time before he asked any of his assistants for corroboration—all guessed what was happening, not only had they heard a faint sound, but they knew from the young inventor's tense expression—then from the hint of emotion in his voice as he handed the receiver over to Kemp. "Can you hear anything?" he asked. "Indeed I do, distinctly," he replied in a loud voice. A mug fell unheeded to the floor. The Atlantic had been bridged, 1,700 miles; Cornwall was calling—yet to Kemp's surprise when he handed on the receiver to Paget—Marconi was not looking in the least jubilant. He had felt certain of his achievement all the time.

After a short time the signals stopped, evidently owing to the changes in the capacity of the aerial wire, which in turn were due to the varying height of the kite; but again at 1.10 p.m. and 2.20 p.m. another succession of three sharp little clicks was distinctly heard.

The following day the signals were heard again, though this time they were not quite so distinct.

On Saturday further attempts were made to obtain a repetition of the signals, but these attempts had to be abandoned owing to difficulties with the kite. There was, however, no doubt that the experiment had been a success.

The world was startled by the achievement, though not everyone believed it. Even Edison, one of Marconi's greatest admirers, suggested that he might have picked up a stray signal. The effect which these criticisms had on Marconi was characteristic. They touched the stubborn streak in him. He now set to work methodically to succeed in a more

convincing way, so there should not be the slightest suggestion of doubt about it. But trouble was looming ahead of him. While all Europe was expecting further news of messages received on Signal Hill, a telegram was received in London. It was from Marconi.

"In consequence of the threatened legal proceedings against myself by the Anglo-American Telegraph Company which claims a monopoly of telegraphic communication in Newfoundland, I am compelled to discontinue wireless telegraph tests between England and this Colony. I hope to continue shortly with similar experiments between England, Canada and the U.S.A."

What the people of Newfoundland thought is well expressed in the following extract from the minutes of a meeting of St. John's Municipal Council held on Friday, 20th December, 1901:

"The Council are much gratified at Signor Marconi's success, making as it does the dawn of a new era in trans-oceanic telegraphy, and deplore the action of the Anglo-American Telegraph Company."

A few days later Marconi abandoned experiments in Newfoundland and began to look round for another site. Professor Graham Bell offered him land at Cape Breton, which is in Nova Scotia. Marconi decided to travel there immediately to view the possibilities of making it an alternative basis. Great indignation was aroused in New York by the treatment meted out to the inventor, especially as the company's monopoly was due to expire in only two years. The New York officials, when approached by the Press, refused to make any comments, and later Mr. F. A. Bevan, chairman of the Anglo-American Telegraph Company, said that the first letter to Marconi was written without his knowledge.

By 22nd December, however, the Canadian Government had offered Marconi every facility to continue his experiments and the next day (Tuesday), in reply to their invitation, he travelled to Ottawa. On the last day of 1901 he was enthusiastically received in Ottawa. A week later he was still there, having extended his visit. He had a cordial reception from Lord Minto, the Governor-General, and Sir Wilfrid Laurier, the Prime Minister, and a dinner was given in his

honour. Finally a decision was made to set up a station at Glace Bay on the Cape Breton coast, sixteen miles from Sydney. The Canadian Government eventually voted £16,000 towards the erection of the station.

On 9th January, Marconi left Ottawa for Montreal in order to have a consultation with Sir Thomas Shaughnessy about the handling of telegraphic business to and from Cape Breton by means of the Canadian Pacific Railway wires. There were already two other telegraphic systems in use in Canada—one the property of the Government and the other owned by the Western Union Company.

Although outwardly Marconi ignored adverse criticism, he was young enough and sensitive enough to feel keenly the scepticism of those for whom he had a great respect. Sir Oliver (then Dr.) Lodge's feeling when he heard that the first signal had been flashed across the Atlantic, was that of a man of science who builds on fact.

He wondered if Marconi could have mistaken "stray" interference for the Morse "S" signal. This was construed much to Lodge's sorrow, as a doubt of the achievement, for on 24th December, less than twelve days after the signal, he wrote to the Press, deploring that his friendly attitude towards Marconi's achievement should have been so much misunderstood.

The Electrical Review, commenting on the achievement, stated: "Marconi must have a wider experience of the effects of atmospheric discharge on his instruments than any man living, and he is not likely to mistake these disturbances for a signal."

It was on 13th January that the famous dinner of the American Institute of Electrical Engineers was held. It had actually been fixed for a later date, but was arranged at forty-eight hours' notice for this date, as Marconi, the guest of honour, was uncertain about how soon he would have to leave New York for England.

The early days of the century can seldom have seen such a distinguished gathering as that which attended at the Waldorf Astoria Hotel in New York, where the dinner was held in the Astor Gallery. There were about three hundred guests and the tables were set out so they could form quart-

ettes and octettes. Along the wall which faced the entrance was a long table, slightly raised on a dais, overshadowed by the huge Star-Spangled Banner. At this table were seated, among others, Professor Steinmetz, Professor Elihu Thomson, Professor Alexander Graham Bell (the inventor of the telephone), Sir Percy Sanderson (British Consul-General), Dr. M. I. Pupin, Professor Crocker, Frank J. Sprages, William Stanley, C. W. Brice, Carl Henry, and Arthur Williams (President of the New York Electrical Society) and Mrs. Thomas Edison, who took her husband's place, as he was unable to be present. A large number of those present had never before seen this Italian inventor, who at such an early age had startled the world and given more elderly scientists a great deal to think about.

Everywhere was displayed the original decorations. The menus were printed in Italian olive ink, on a background of sea-foam green, but the most interesting feature about these cards was the picture at the top. A vast expanse of ocean was portrayed, at either side the two bordering Atlantic coasts, with Marconi masts upon lighthouses. From these signals were passing . . . "S"—"S"—"S." In the centre was a medallion in which was set Marconi's portrait draped with the Italian flag.

The lighting of the gallery was disposed in a picturesque manner. Around the rooms a system of flexible conductors had been installed, with sockets in which lamps could be placed to form any design or device—a novel device in 1902. On some of the tables were twined great coils with small green lamps. At either end of the room were two large tablets, one bearing the word "Poldhu" and the other "St. John's."

After Professor Steinmetz's greeting to the gathering, messages were read from those who were unavoidably absent. Edison, unable to come, said: "I am sorry I am prevented from attending your annual dinner to-night, especially as I would like to pay my respects to Marconi, the young man who had the monumental audacity to attempt, and succeed in, jumping an electric wave across the Atlantic."

Marconi's address to the company was characteristic of him. He has been accused of that smug breed of false modesty

which is to be associated with intellectuals of the previous mode. In the United States, particularly, he was misunderstood. That gathering was essentially a hearty tribute to a young man who had just won the profound respect of a nation. Half measures were as absent from the scheme of things as were half statements.

When Marconi rose to speak he made no echo of the praises which had been sung. He spoke slowly and precisely of the way in which he had accumulated his knowledge and his ideas. He explained what he owed to Clerk, Maxwell, to Lord Kelvin. He indicated what he owed to Professor Henry and to Hertz and others. It could easily be understood how that American gathering came to have the idea that this young Italian had, in truth, invented nothing and accomplished little that did not follow naturally from the work done by others before him. Of Professor A. Graham Bell (who was sitting at Marconi's right hand) he spoke in the same level way. The message received at St. John's came through one of Professor Bell's telephones.

His little speech was logical, and what he sincerely believed, and Marconi was given a tumultuous reception when he ended. Yet, even to-day the American mind is puzzled at the detached way in which Marconi approached the problems of his work.

To the Press later he confided that he was not satisfied because he had received the "S" signal from Poldhu, but because it had been so successfully repeated at varying speeds. Those speeds were from two or three words a minute to approximately thirty words a minute. The wide publicity of his reception in New York brought many queer letters. There were still many people who did not approve of the idea of wireless on the grounds that it was interfering with nature. Then there were others, more practically-minded, who wished to suggest names in connection with its various aspects. "Aerograms" was a name suggested for telegrams sent by wireless. Marconi was always interested in his correspondence, and the ideas put to him.

On 26th January, Marconi returned to England in time for the Fifth Ordinary General Meeting of Marconi's Wireless Telegraph Company. The company then had its offices

(which were very modest ones) at 18, Finch Lane, in the City of London. He was able to tell the directors and shareholders of their success at Signal Hill. Sir Charles Euan Smith presided, and Marconi's address was received with great enthusiasm. He explained why it had been undesirable to continue with the experiments from Newfoundland, in the face of the attitude of the Anglo-American Telegraph Company. He also referred to criticism he had received, even in some instances from those who might be considered his friends. The signal "S" had been transmitted at the first Transatlantic experiment, he said, because it was the easiest Morse signal to transmit. He added that it was more than a year since he had first sent messages for more than 200 miles. In that time he was confident that he had learned to distinguish "strays." He also denied with confidence the suggestion that wireless would never be able to compete with other methods of transmitting messages.

Although he has never admitted it, Marconi felt hurt at adverse criticisms uttered by his old patron and helper, Sir William Preece, and his equally good friend, Dr. Lodge. Both these men had emphasized the point that, whereas by cable it was possible to transmit more than forty words a minute, with the very latest wireless apparatus only twenty-two words a minute were possible. He knew that only time was needed to perfect his apparatus in order to make radio telegraphy supersede the older methods.

On 22nd February, he set off once more for Canada, this time to make arrangements for the construction of the huge Station at Glace Bay. During his absence in England the Canadian Government at Ottawa, on 14th February, had made arrangements for the reduction of the present Marconi message rates from 25 cents to 10 cents a word in return for their services in contributing towards the erection of the stations. Later in the month, an agreement between Marconi and the Dominion Government was laid on the table of the Canadian House of Commons. In it the contribution towards the wireless station to be erected at Cape Breton was put at £16,000.

It was also in 1901 (April) that the American rights in Marconi's invention were sold by the Parent Company to

an American Company for £50,000, and shares in the American Company with a controlling interest. About this time also, more was heard concerning Professor Slaby. In Marconi's early days of experiment, he had welcomed an opportunity to give the German Professor a demonstration of his apparatus. Later the professor, in conjunction with one or two other scientists, started a German company. It was successful in many of their experiments, but not to such an extent as Marconi. It was quite obvious that Slaby's system owed a great deal to Marconi; the Professor had fully obeyed the instructions of his Imperial master, when he visited London and met the young inventor for the first time; despite all this, however, he argued that his system was entirely different from Marconi's.

It requires little imagination to realize how such a situation and other similar ones were bound to arise from time to time. For example, there was a rather curious instance of this kind which concerned the Marchese Solari, an officer in the Italian Navy and friend of the inventor. During the summer, the King of Italy had placed the first-class cruiser *Carlo Alberto* at Marconi's disposal for six months, so that he might carry out a series of long-distance tests, in various places and under different circumstances.

The Marchese Solari, with Marconi's assistants, was given the task of installing wireless apparatus on this flagship, and therefore he was greatly perturbed when Professor Sylvanus Thompson suggested that one of the coherers used was the invention of a seaman named Castelli. As a matter of fact, it was invented by Solari himself and as the "Solari tube" it became widely known. Actually, it was the property of the Italian Government, and it was in accordance with their instructions and those of Admiral Mirabello, that it was installed on the *Carlo Alberto*.

Rather more colour was lent to this story, which was really only gossip, by the discovery made by certain enquiring persons that Solari had been some time before he patented the invention.

This Solari admitted was perfectly true—but he gave the reason, which had not been told—he had an idea that he had read somewhere about something similar and wished

to trace it. Later he did so—to *Fahie's History of Wireless*, published September, 1899.

It is worthy of note that whatever criticisms were levelled against the Marconi apparatus and anything connected with it, there were always a number of people ready to throw themselves into the breach to defend the inventor. One of his most loyal champions was Mr. Henniker Heaton, M.P., who described Marconi as a "man who had given his youth to working for England, having taken out already, in those early days, 130 patents, all benefiting Great Britain."

CHAPTER V

THE CRUISE OF "CARLO ALBERTO"

IT was during 1903, a period when wireless telegraphy began to make big strides, that Marconi first discovered what is now a well-known fact that wireless signals can usually be received over much greater distances at night than in day-time. He had suspected this for some time, but first carefully tested the phenomena during a voyage in the American liner *Philadelphia*. He then received messages from distances of 700 miles by day and over 2,000 by night.

After reading a paper dealing with this phenomenon before the Royal Society on 12th June, 1902, his conclusions and theories were severely criticized. Many even questioned his results, but later experience fully confirmed his observations.

Throughout his work, however, he received the unswerving support of the King of Italy—to this day on every possible occasion Marconi will speak of the encouragement he received, first from King Umberto, and then from his son, Victor Emmanuel III, who succeeded his father in 1900. The members of the Marconi Company, those early pioneers of wireless—Kemp, Bullock, Bradfield, and some half a dozen others—all showed the same spirit of splendid loyalty which was the inventor's greatest help in his work and chief solace when unfairly criticized.

An important patent was taken out in 1902, when Marconi designed and registered a practical form of magnetic detector based on the effect of electrical waves on iron and steel when subjected to a varying magnetic field. This magnetic receiver replaced the receivers which had been in use up to that date, and remained for more than ten years the standard receiver in the great majority of sea-going vessels equipped with wireless. It was called with commendable simplicity the magnetic detector, and was first used by Marconi with outstanding success on 15th July, 1902. He was then cruising

and making tests on the *Carlo Alberto*. They had arrived that morning at Kronstadt and determining to give the new receiver a severe test, they lay there awaiting messages from Poldhu. This was the first time signals had been attempted over land for such a long distance. With his Magnetic Detector it was possible to give and receive signals independently, so that other English stations were unable to interfere. Even this system, though, was found to give better results at night, and it was not until after nightfall that signals from Poldhu were successfully received.

Marconi's arrival at Kronstadt caused a good deal of excitement. For one reason the King of Italy was on board the *Carlo Alberto*, as well as the inventor; he wished to visit the Czar and took the opportunity of travelling on the flagship, so that he might see wireless experiments being carried out at sea. The first Russian visitor to come on board was Admiral Makaroff, of the warship *Peter Paulovsky*. The Admiral was much impressed and declared that he would not be satisfied until the Czar himself had witnessed wireless signals being received. Marconi, therefore, was quite prepared for the arrival next morning at 11 a.m. (16th July) of the Imperial Yacht *Alexandria*, which had aboard the Czar of Russia and several members of the Court. The King of Italy was, of course, present, anxious to see more triumphs for his subject.

The Czar was escorted aboard the *Carlo Alberto*, and the wireless apparatus was shown to him. He remained for more than an hour talking and asking the inventor many questions; most of his enquiries showed that he had read and studied a good deal about the invention. He was particularly interested in the telegram which had arrived from Cornwall the previous day. At last his visit could not be prolonged, though it seemed as if he would have liked to remain longer. "I am assured your invention has tremendous possibilities, Signor Marconi," he said, speaking in English. "It should prove a blessing to all." Marconi bowed and the Royal guest departed.

There was, however, a sequel to the visit when the next day an official arrived with a decoration from His Imperial Majesty, therefore removing all possible doubts as to his keen interest.

Leaving the Russian shores, Marconi continued his North Sea cruise, first by visiting the coast of Sweden and thence travelling to Kiel. Here the Germans were inclined to doubt what Marconi had achieved and laughed when they were told by some of the officers of the *Carlo Alberto* that messages were being received daily from England. Throughout the entire history of Marconi's early efforts and later experiments, Germany was the only country which exhibited any bitterness of feeling towards him and his work. There had been intense jealousy ever since Professor Slaby's first meeting with the young inventor, more than five years earlier. Probably there was more bad feeling than there would have been otherwise because Professor Slaby's intentions had appeared so transparent to everyone when he had intended them to appear in a different light altogether. After the war, it is true a good deal of this backdoor hostility disappeared with the international adoption of radio as part of daily life. But it certainly continued to exist until 1914.

During the Kiel visit the Kaiser was aboard his yacht the *Hohenzollern* and he took all the opportunities he could to learn what Marconi and his assistants were doing, but he did not go aboard the Italian ship. However, Marconi was to meet the Kaiser and Germany again. It was after the final success of Marconi's experiments across the Atlantic, when he was invited to Rome as the guest of the Italian Government. The Kaiser, a guest of the King of Italy, was staying at the Quirinal Palace. During dinner one evening Marconi was discussing wireless with the Emperor.

"Signor Marconi," the Kaiser said, "you must not think that I have any animosity against yourself, but I do object to the policy of your Company." Marconi's diplomatic reply was, "Your Imperial Majesty, I should be overwhelmed if I thought you had any personal animosity against myself." The Kaiser's objection was, of course, to the firm stand which the Marconi Companies took in regard to the communications from German ships. They were not allowed to communicate with ships which were equipped with the Marconi apparatus.

After his departure from Kiel, Marconi cruised towards the South down the Portuguese coast, reaching Ferrol in

Spain on 30th August, where a number of Spanish telegraphists who came aboard were agreeably surprised to learn that messages were being received daily by the *Carlo Alberto* from Poldhu. There was a good deal of excitement among the crew when Gibraltar was reached, but Marconi, as usual, kept calm, even if a little excitement burned within him. The reason for this excitement was Teutonic in origin. At Kiel there had been no mincing of words. German scientists had stated very definitely that the mass of rock would interfere with the reception by the *Carlo Alberto*, of messages from Poldhu. The Italian, they said, was overambitious about his alleged messages from England; wait a while, when they came to an obstacle (Gibraltar, for example): there would be a change of opinion then. Marconi's friend and stout supporter, Admiral Mirabello, had been restrained with difficulty from giving vivid expression to his strong opinions in the matter —there was no doubt about it, feeling ran high in the Italian ship.

During the early part of the night after their arrival a message was most anxiously awaited. Midnight came and there was no signal. Few retired to sleep that night on the Italian cruiser. There was nothing to be done, however, but wait a little longer. At 3.15 a.m. a messenger burst into the Admiral's cabin. A message was coming through from Cornwall, he reported.

"The Empress of Russia has had a miscarriage," they read at length. Bad news for the Russians, anxious for an heir to the throne, but good news for Admiral Mirabello and his crew.

There are few occasions when evil tidings bring good news at the same time.

From Gibraltar the *Carlo Alberto* continued her cruise along the Northern coasts of Africa, receiving at all points messages by night, but unable by day to bridge a distance of more than 500 miles.

Back in Italy, Marconi was received with enthusiasm as a national hero. But he had little time to spare. Much work remained to be done while Vyvyan and others were hard at work completing the Glace Bay Station at Cape Breton. Early in September he began directing the operations at

Coltano, where a great station was being erected. It was at this time that he began to see a way which might overcome the difficulties of transmission in broad daylight, and he occupied much of his time in research to this end. Before the end of September he was able to establish communication by wireless with the Atlantic Squadron and also with ships in the Mediterranean.

Among his intimate friends Marconi, though a busy man, was always "good company." He possessed a mischievous humour, probably inherited from his Gaelic ancestors. Few men became more intimate with him than Admiral Mirabello of the *Carlo Alberto*. With the Admiral, Marconi's nature showed its gayer side, for the old sailor was a bachelor and not averse to the more obvious enjoyments. He grew to look on Marconi in the light of an adopted son, and admits to having teased him upon many occasions. When it was decided by the King of Italy and the Italian Government to offer the *Carlo Alberto* to Marconi for his trip to Glace Bay, it was a great disappointment to him that the Admiral was not allowed to sail in her, too.

The old sea-dog, for his part, was very much upset when he realized that he would have to part from his young friend. There is record of a warm public embrace on the occasion of farewell. "You never liked my strong cigars," he said. "But that was a detail—I have given my life in the service of the sea—and my country. I have no family, but you have been like a son to me, I shall never forget the time we have spent together."

His parting gift to Marconi was the Italian flag which had been his pride while in command of the flagship *Carlo Alberto*. Marconi cheered the old man up by telling him that the flag should fly on the most prominent tower at the Glace Bay Station, which promise in due course was faithfully carried out.

When Marconi arrived at Plymouth to sail for Canada, he met with a great ovation. As soon as he landed he found himself surrounded with phlegmatic Britons who so far forgot themselves as to sing vociferously "For he's a jolly good fellow."

The journey to Canada was not a pleasant one. Terrible



[*Marconi Wireless Telegraph Co., Ltd.*

MARCONI IN 1896, AT THE TIME OF HIS ARRIVAL IN LONDON, WITH THE EARLIEST APPARATUS

storms raged the whole time: they were equinoctial gales at their worst; even a sea-lover like Marconi was glad when the voyage came to an end and they were all safely landed at Glace Bay on 31st October, 1902. The station was now complete. During the entire voyage messages were received by the *Carlo Alberto* from Poldhu, but only during the night. As yet only a distance of about 500 miles could be obtained by day.

Marconi only remained at Glace Bay for short periods, but this first visit was of rather longer duration. He has not forgotten it either—the cold was intense, and the stillness of the Canadian winter strange indeed to one not only used to southerly climes but to city life. Despite the cold, however, the air was exhilarating, and he found it a place where he could work hard and sleep well. There was, too, a certain charm about the wide expanse of untouched snow to be seen for months after the first heavy falls of winter had taken place, actually at the end of October, and no one could have been insensible to the beauty of lone pines with their tracery of dark branches outlined with snow, clear against the sky, as if etched there by some supernatural pencil.

Glace Bay is situated some sixteen miles from Port Sydney, and although the coast at that point is not really distinguished by any particular elevation, the actual site of the station was on a promontory seventy feet above the sea-level.

On this cliff-top four towers, built in the angles of a square rose to a height of some 215 feet. Trellis woodwork surrounded these, strengthened by bands of steel bedded into foundations of concrete. Wood was used in the structure owing to the fact that structures of steel tended to absorb some of the electric energy which was required to pass through the ether. Between two of the towers was stretched a wire, to which in turn were attached about fifty wires from the operating room.

It was found necessary to provide current much stronger than had ever been needed before for wireless purposes, and this exposed a drawback to Glace Bay as a station. The spot was far distant from any of the electrical manufacturing centres. Communication with these centres at first was

difficult. Visitors to the station could judge a little, the strength of the current, when they saw the flash which accompanied every movement of the operator's hand. The concussion that followed these flashes was like the sound of firing from a Lewis-gun—a fact which made a deep impression on the Boston journalists who paid a visit to the station.

From 1st November experiments with the signals from Poldhu began in earnest. The first results were anything but favourable. The messages were sometimes quite unintelligible and always very weak. At first he thought that perhaps the power given out from Poldhu was not strong enough. Vyvyan, who had supervised the construction of the Glace Bay Station during Marconi's absence in Europe, states:

"A large number of experiments were carried out, with many different arrangements of plant and aerials. Some combinations gave good results, some poor, but an arrangement that had good results one night, gave poor ones the next . . . so it became difficult to state if much progress was being made. In the light of our present-day knowledge, it is easy to see where the trouble lay. We knew nothing then about the length of wave transmitted governing the distance over which the communication could be effected.

We did not at Glace Bay even have the means or instruments for measuring wave-lengths. In fact, we did not know what wave-length we were using. Actually, we had arranged the aerial and circuits to transmit a wave-length of about 2,000 metres, which was far too short for the distance, and unreliable, even as a night wave. Had Marconi originally by an accident arranged the transmitting circuits to emit a wave-length of three or four times the length he actually used, the transatlantic communication would have been effected sooner and far more easily. But this might have been a doubtful blessing, because the difficulties experienced led to many investigations, resulting in developments which otherwise might not have been undertaken."

By early December readable messages were being received at Poldhu. Marconi was working night and day now to get the system more perfect, for, despite the fact that in November triumphant Press reports had appeared in the Italian news-

papers concerning the fact that messages from Poldhu had been received aboard the *Carlo Alberto* during her entire outward voyage, adverse criticisms were now appearing in other European newspapers. Beside this there was financial pressure to be considered.

When on 15th December the word *Greentime* was safely and clearly transmitted, and later *Yellowtime*, there was rejoicing among the staff of Glace Bay Station—jubilation in which the crew of the *Carlo Alberto* stationed in Sydney Harbour were not slow to join. As the Marchese de Solari said at the time: "There could not have been greater excitement when Christopher Columbus exclaimed those famous words: *'Terra E vista.'* Only Columbus's crew doubted him. Never Marconi's."

Actually the first message was sent to *The Times* by their correspondent, Doctor Parkin, who later became Sir George Parkin. Although this message was received satisfactorily at Poldhu, it was not sent on to its destination, because it was Marconi's particular wish that the King of Italy and the King of Great Britain should be the first to receive messages.

To King Edward Marconi sent the following message:

Lord Knollys, Buckingham Palace, London.
Upon occasion of first wireless telegraphic communication across Atlantic Ocean may I be permitted to present by means of this wireless telegram transmitted from Canada to England my respectful homage to His Majesty the King. G. Marconi. Glace Bay.

At the same time Lord Minto sent the following message:

To His Majesty the King. May I be permitted by means of first wireless message to congratulate your Majesty on success of Marconi's great invention connecting Canada and England. Minto.

A message was also transmitted to the King of Italy, in Italian. This read:

General Brusati, Rome. On the first occasion of the transmission of radio telegraph across the Atlantic thus linking across space the Old World with the New I wish to pay my devoted homage to His Majesty the King. Guglielmo Marconi.

A reply by cable was received by the inventor from King Edward, who had not forgotten his experience at Osborne in 1898. The King of Italy also sent a special telegram to Marconi. Queen Margharita was specially delighted. She had always taken a keen interest in every step of progress made by Marconi ever since she first inspected his instruments in 1897.

Thirty-eight messages were sent between 21st December and 14th January. Some came through with little difficulty. Others had to be repeated a good many times before the text was obtained correctly. Vyvyan at this time was presented by his wife with a daughter. A radio telegram was sent to *The Times* for inclusion in the column announcing births and deaths. On despatch it read: "Jan. 3rd wife of R. N. Vyvyan, Chief Engineer Marconi's Canadian Station, of a daughter." Atmospherics converted "Jan" into Jane, and so the published notice read: "Jane, third wife of R. N. Vyvyan . . ."

The Canadian Government sent a special message of congratulation to the British people, through the medium of *The Times*, signed by Mr. Cartwright, then the acting Premier. *The Times* had progressed a long way since its despatches from the Isle of Wight on the doubtful subject of that apparatus "on the top of a pole."

President Roosevelt (Theodore Roosevelt) also sent a telegram of congratulation to King Edward. This was sent on 18th January from Cape Cod to Glace Bay with a request that it should be forwarded thence to Cornwall.

On 22nd January experiments of any importance ceased for a time and Marconi set sail once more for England.

The engineers who remained at the station must have had a rather lonely winter, though they appeared to take to it quite kindly, making all the use they could of the amenities offered by the neighbourhood. Shooting, it must be admitted, was not as good as it might have been, but the fishing was extremely good.

Tobogganing was, of course, indulged in, and snow-shoes and even skis were tried out, but it must be remembered in 1902 winter sports were not indulged in as they are to-day, and not nearly so many people were "wise" to varieties of enjoyment suitable to a North Canadian winter.

In the summer it was delightful to camp for a day or two on the banks of a river some seventeen miles from the station, and many of the men made use of this delightful district for a few days' holiday every now and then.

The *Carlo Alberto* did not remain long in Sydney Harbour after Marconi had left; they set sail for Venezuela, making an agreeable change for the southern crew from the northern winter.

It was a Saturday when Marconi arrived at Liverpool, on 7th February, 1903. He travelled in the *Etruria*, which was fitted with wireless, and crowds went to the docks to see the ship come in. Public imagination was fired at last, yet despite this fact, there was still an uphill fight for the inventor. Many thought as Mr. H. W. Tyler did, when he wrote from the Carlton Club to *The Times*: Why not, he asked, a direct telegraphic communication between Poldhu and the nearest Post Office? There need not be any carping about two miles of telegraph wire, and possibly an extra clerk. Poldhu should be connected with the Postal system.

There were many pleas from the public for the Post Office to make use of wireless telegraphy. Thus at the Sixth Annual Meeting of the Marconi Company, held this time at the Cannon Street Hotel under the chairmanship of Sir Charles Euan Wallace, it was stated that the Admiralty and General Post Office were "coming to some arrangements" and that Sir Austen Chamberlain was in favour of "some scheme."

This meeting was also notable for the fact that for the first time the directors could announce that income had exceeded the expenditure. The cost of shore stations was very high indeed, but many ships were now having wireless installation aboard, which more than effected a balance. Marconi stated that the Company's record was one of steady progress since the first message across the Atlantic on 21st December, 1902. Hundreds of messages had now been sent and received and *The Times* was now taking messages and paying for them at Press rates. Thanks to the Italian Government allowing them the use of the *Carlo Alberto* he added, some £3,000 monthly was saved.

A proposal at this time had been made to establish communication between Australia and New Zealand. Already the

Russian authorities were employing radio telegraphy between Odessa and Varna, with lines crossing Rumania. It was being used in Somaliland but with little success. Instruments were delicate and Marconi stated that he had no doubt that the failure in some parts of the world was due to the employment of operators who had no expert knowledge. By June the Danes were in very satisfactory communication with Iceland.

Those early dreams seemed on their way to materialization, yet Marconi had a solid body of criticism to meet. Judging by his attitude towards those who belittled his achievements, it is indeed difficult to remember that Latin and Celtic blood ran in Marconi's veins. His outward calm was more in keeping with Anglo-Saxon traditions. "I knew," he has said, "that certain things would be eventually accomplished judging by what had been done already. I knew that it was only a matter of time. Nevertheless I must admit there were occasions when I would have given a great deal to hurry things on."

No country had spoken more highly of his achievements than Canada, yet on 9th May, 1903, at Ottawa, Mr. Fielding, Dominion Minister of Finance, declared that wireless had not been a complete success and he hoped that the Government would not offer further contributions towards the building and upkeep of stations. Vyvyan, in charge of Glace Bay Station, had not any breakdowns to report. There seemed to be no reason at all for the attack, but it was very typical of the kind of set-backs which Marconi and his Companies had to face, and again throughout the development and progress of wireless.

In England also there were some who sought to depreciate what Marconi had achieved. On 4th June, Dr. Fleming gave a lecture at the Royal Institute. He explained that the lecture was to be illustrated by messages actually received from Poldhu, but it was in no way an exhibition of syntonic wireless. The lecture began at 5 p.m. and all went well for a time. Some messages were received from Poldhu via Chelmsford, then they ceased to come through clearly. Dr. Fleming at once realised that interference on the same wave-length was taking place. This he described as "scientific hooliganism."

For a while after the lecture, no discovery was made as

to what this interruption was due, until those responsible confessed in a letter to the Press. They were Neville Maskelyne (known to the general public because of his association with Maskelyne and Cook) and Dr. Manders.

It is stated by Mr. Jasper Maskelyne, son of the late Neville Maskelyne, that before the Professor lectured Mr. Maskelyne bet him that he would upset the meeting, however far away he happened to be at the time. The Professor was optimistic; he thought the interruption would not take place.

However, in the middle of the lecture, a message began to tap out on the instrument. It took a few minutes to spell it out carefully, "Mary had a little lamb," a message which made the audience laugh, but not the lecturer. At the time this caused a good deal of controversy and Mr. Maskelyne was severely criticized by a few people for playing such a trick. When he wrote to the Press he explained that in doing what he had, he considered that he was serving the cause of science; he had, he said, proved that interference could be brought to bear upon wireless. Mr. Maskelyne was interested in wireless throughout his life and patented a large number of devices concerned with it.

Maskelyne and his confederates were wrong in one assertion at least—that was when they suggested that the messages had been on the way from Poldhu since 11 a.m. when the fact was—a telegram asking Marconi to send the messages through before six o'clock, was only sent to Cornwall by Captain Dewar at 3 p.m.

Mr. Henniker Heaton referred to the incident as "impudent interference" and criticized Dr. Fleming also for explanations which he thought were not as clear as they should be. Meanwhile the inventor himself was busy with further experiments and not worrying very much about these "tea-cup storms."

It was a much more important event to him, when on 12th August, it was decided that his system should replace the German system on the Hamburg-Amerika liner *Deutschland*. This decision was not made because of any particular fault in the German system, but simply because it was not nearly so advanced as the Marconi system, and so not nearly such satisfactory results could be obtained.

CHAPTER VI

MARCONI AND EDISON

ON 29th August, Marconi arrived in New York and, as was now customary, he was received enthusiastically, though his distant manner damped the ardour of the journalists, who were there to ask their pointless questions. Marconi made this journey to America in the S.S. *Lucania*, also returning in the same ship. Before sailing, Marconi had the *Lucania* fitted, not only with the usual apparatus, but with additional devices fixed to the aft mast. These were connected with Marconi's own cabin, the purpose being to judge by means of a special indicator the intensity of power required for messages at given distances. Formerly this had been, in a measure, guess-work; now his object was to gauge to a nicety the amount of power needed, at various states over the entire distance.

One Tuesday morning, Marconi was sitting waiting in his cabin when from Poldhu came a message giving yacht race results. Although the liner was in mid-ocean, the report was received without a mistake. On Friday, the Nantucket Station gave results of racing which had taken place the previous day.

It is not difficult to imagine the tremendous interest aroused among the passengers throughout the voyage. "Whenever I appeared on deck, I was inundated with questions from all kinds of people—" By this time however the inventor had become accustomed to answering questions—and sometimes avoiding them.

With his arrival in New York, Marconi devoted himself to the principal object of his American visit. This was to see Edison. He wanted to consult the American inventor about some inventions which the latter was developing with a view to improving the Marconi system. One scheme Edison had in mind was to reduce by half the high power then required for transmission.

A great respect existed mutually between these two men, who had already met several times. It will be remembered

that indisposition prevented Edison from being present at the dinner given to Marconi after his first signals across the Atlantic, but that his wife had been present instead. Mrs. Edison, like her husband, was greatly interested in Marconi and his work. She is described by Marconi, as a "very beautiful woman, who was always charming to me."

Of Marconi, Edison had said many times that the world would scarcely be capable of realizing all that he had done. When he heard of the change on the Hamburg-Amerika line, he declared publicly that the German plan to cripple Marconi's system by the erection of an opposition wireless station on the Baltic Coast was doomed to failure. Edison from the earliest had always insisted that when wireless was perfected it would be just as simple to use as ordinary telegraphy. He had also predicted the ultimate success of transatlantic wireless, with, he added, a speed of 500 words a minute.

One characteristic of Marconi, which has undoubtedly played its part in its success, is the respect which he has always held and still holds for the achievements of others. Though he has never underestimated his own powers, he has never had an inflated idea of his own importance. No man has ever been more eager to hear about the important achievements of others than Marconi. He always considered Edison a great man, and whenever he was going to see him, looked forward to the meeting with rather more than pleasant anticipation.

At that time Edison, who was about fifty-six years of age, was living in a large, rambling, old-fashioned house at Orange, New Jersey (now a residential suburb of New York) but then about forty minutes train journey from the City. In a letter which awaited Marconi upon his arrival in New York, Edison asked him to come to Orange at the week-end, when there would be plenty of time to talk things over.

By Saturday afternoon Marconi had completed some other affairs which he had to attend to and finding that there was quite a good train service to Orange on Sundays, decided to visit Edison, according to his invitation, the following morning.

There were rumours in the air that Marconi and Edison were going to meet, for anything these two men did was "copy" for the New York "news" hunters and reporters,

but as they were totally unaware of the time this meeting was to take place, Marconi, accompanied by the Marchese Solari, was enabled to leave his hotel and set forth for the visit without any annoyance.

Tickets were taken at the depot without anyone recognizing them. Arriving at Orange, it did not take very long to reach Edison's house. As it was a bright sunny morning, they made the journey on foot. A few minutes elapsed between their arrival at the house and their admission by Edison himself. There were several violent raps on the tall oak door, and some vigorous bell-ringing. "Perhaps he has forgotten we were coming," Marconi said, remembering that Edison, when busy with an invention, was apt to forget everything else.

All such fears were put to rest when Edison appeared and gave the young inventor a warm welcome, congratulating him at once upon the experiments he had carried out in the *Lucania* coming over.

An enquiry after Mrs. Edison's health, from Marconi, elicited the fact that she was away from home for a few days. Without any further preliminaries Edison suggested that they should all go to his workshop, where he had been engaged upon some work, at the time of their arrival (which accounted for the delay on the doorstep). With a smile Edison looked down at the clothes he was wearing, "My working outfit," he remarked.

It transpired that Edison had just been carrying out some experiments with filaments for electric light bulbs, and he spent a few minutes explaining to his visitors what he had been doing.

Edison's workshop was a large, well-lighted room, with several benches and tables piled up with all kinds of apparatus and gear, a good deal of which only he knew the use of. In the far corner was a couch, on which Edison would take occasional snatches of sleep, when work in hand would not permit of his taking a night's rest.

There was much to discuss between the two inventors, notes and experiments to compare, a world of theory to propound, when the recital of facts which had already happened was completed. Time passed on wings, and the Marchese Solari began to be acutely aware that his breakfast, viewed

from the angle of the present circumstances, had been grossly inadequate. In other words, he was feeling desperately hungry. They had arrived at Edison's home some time before noon, and it was now nearly two o'clock.

Presently the Marchese caught Marconi's eye, and by dumb show indicated that sustenance was somewhat overdue. It was obvious from the slight grimace which Marconi made in return, that he, too, was suffering from the pangs of hunger. However, he continued to talk to Edison, but now and then glanced at the clock which hung on the wall, and ticked out the minutes so unheeded by his host.

At last he remarked, diplomatically: "How do you manage about your meals, Edison. Your times are different. We lunch earlier in Italy than you do here."

Edison replied:

"I generally let the servants go out on Sundays. It does not make any difference to me. The house is quieter, and as for meals, well, I can get along with a sandwich or something."

Then as if a sudden thought struck him, Edison remarked, "You have had lunch, of course?"

A sigh of relief escaped the Marchese. When he heard the subject thus clearly broached, Marconi shrugged his shoulders politely, "Well," he began, "as a matter of fact—we——"

"Good gracious," apologized the American, "here we have been talking all this time, it is long after two o'clock and you are both hungry. I don't know quite what we had better do, though; the maids will not be back until to-night."

It was Marconi who suggested that they might forage for themselves in the larder and expressed his own preference for the simplest food. Unfortunately, the larders did not yield a great variety, Edison admitted that he had not told his staff that he expected friends, and of course with his wife away —well, that accounted for a good deal.

However, plenty of excellent cheese was found, plenty of bread and a good supply of biscuits. "I am sorry that I cannot offer you any whisky," said Edison, "but as you know I never take anything but water." Eventually with the assistance of the Marchese Solari, a kettle was boiled and some tea made. If the meal was not a great success from the gourmet's point of view, it was sufficiently sustaining, and the

conversation must have been notable in the history of the progress of the world. Two minds were in contact exchanging ideas that served to remodel many aspects of life. Judged then from the scientific aspect, the impromptu luncheon was a success; certainly Marconi looks back upon it as a happy, if also amusing, experience.

The return journey to New York was made in the late afternoon and it is on record that immediately upon arrival at their hotel Marconi and Solari ate a good dinner.

Peace, however, was never of very lengthy duration for Marconi, and before the evening had given place to night, reporters were demanding to see Marconi—for the news had leaked out that the two inventors had met and consulted one another.

Almost at the same moment, other enterprising newspaper men were invading Edison's home at Orange. However, all their persuasive powers availed them nothing, for neither the Italian or the American would say one word.

During this visit Marconi was often in touch with Edison. He was beginning to feel the weight of hostile criticism, but Edison was always on his side. As Marconi's system of telegraphy was tested and definitely removed from the experimental stage, there came a division of opinion. The great majority accepted what he had to show them, wholeheartedly. Others still doubted. This was, of course, only what might be expected, as was the next stage, when rival systems of wireless telegraphy appeared. It became obvious that many were intensely jealous of the Italian inventor's continued success. Doubts were expressed anew as to whether Marconi was actually the inventor of wireless.

These doubts began to be expressed rather persistently towards the end of 1908, Germany particularly being anxious to further what she claimed as an invention of one of her own countrymen.

Before continuing with this controversy it is well to look ahead for a moment and quote from the judgment which was given by Judge William K. Townsend, of the United States Circuit Court, on 4th May, 1905, in the action, "Marconi Wireless Telegraph Company of America *versus* De Forest Wireless Telegraph Company."

"It would seem, therefore, to be sufficient answer to the attempts to belittle Marconi's great invention, that with the whole scientific world awakened by the disclosures of Hertz in 1887 to the new and undeveloped possibilities of electric waves, nine years elapsed without a single practically or commercially successful result, and that Marconi was the first to describe, and the first to achieve, the transmission of definite and intelligible signals by means of Hertzian waves."

The controversy at this period was keen, but it can now be established that the exact contribution of Marconi to the science of spark telegraphy is as follows: Maxwell and Crookes promulgated the theory of electrical oscillations by means of disruptive discharge. Hertz produced these oscillations and described their characteristics. Lodge and Popoff, the Russian scientist, devised apparatus limited to lecture, or local experiment, or to such impracticable purposes as the observation of thunder-storms.

It was Marconi who discovered the possibility of making these discoveries practicable by transforming these oscillations into definite signals; and, availing himself of the means then at hand, combining the abandoned and laboratory apparatus and developing them into a complete system capable of commercially utilizing the discovery.

Other inventors, it would seem, ventured into the fields of electrical movement and discovery, but although they met the Hertzian waves, they failed to appreciate their significance in the future of the world's commerce.

They closely studied and noted their various manifestations, suspected their possibilities, disclosed their varying and various characteristics, but they hesitated anticipating all kinds of barriers which would prove their discoveries impracticable.

Marconi, young and enthusiastic, with the single purpose to succeed, feared none of these things. He persisted and made his system of telegraphy practicable for all the world. He himself has never denied his debt to the great minds that came before him. At the time of his meeting with Edison, however, these things were not clear.

In September, 1903, a conference was held in Berlin at which it was suggested that messages should be received by any wireless stations, wherever they might be situated, regardless

of system. Italy would not enter into this agreement being bound to the Marconi system for fourteen years. Great Britain also refused to sign. On 10th October, which in 1903 fell upon a Saturday, Marconi arrived at Liverpool in the *Lucania*, the Cunard liner in which he had made several interesting journeys. Throughout the voyage, as upon the previous occasion, a daily news bulletin was issued, but this time with a difference. Messages were now received simultaneously from both England and America, for the first time in history. The previous year when the King of Italy had placed the *Carlo Alberto* at Marconi's disposal, messages had been received from Cornwall, but neither the yacht nor the station at Glace Bay had then been equipped so that simultaneous messages from East to West or West to East, could be sent from shore to shore.

The American Press was awakening rapidly to the great possibility of wireless communications for the transmission of news.

In the face of these events it is interesting to note that on 27th October arrangements were being made for the test between Holyhead and Dublin of the De Forest system of wireless transmission.

Early in November, Marconi returned to Italy, where the keenest interest was still taken in the extension of wireless. The Italian Government had recently agreed to assist and investigate a new form of direction finder originated by Professor Alessandro Artom. Motor-cars for general use were only just becoming popular in 1904. On 28th May, 1904, King Victor Emmanuel motored from Pisato Coltana, accompanied by Marconi. At many points on the route the Royal car was cheered lustily by the peasants. This journey was undertaken to decide the site of a new wireless station.

Coltano is situated only a few miles from Pisa, near the famous Royal Estate at San Rossore. Marconi and the King discussed fully their ideas about this new station, which was to mark a great epoch in the development of wireless in Italy.

"His Majesty agreed" Marconi is reported to have said at the time, "that it was fitting that the largest wireless station should be installed in our country. Also, it was to have a stately appearance, and was to be built, as are so many Italian edi-

fices, of stone, which in our climate does not discolour, as it does in England."

From Coltano it would be possible to communicate with Great Britain. As far as arrangements could be made then, it was planned that the station might not be ready before August, but that it would be opened before its entire completion by Marconi when he returned to Italy in July.

Contemporary Italian newspapers are full of accounts of the wonders which were to be erected at Coltano; this station, the entire nation felt, would be Italy's own real illustration of the feats made possible by her great son.

On 3rd February, 1904, the Marconi International Marine Communication Company held their 4th Ordinary General Meeting at 18, Finch Lane, where Major Flood Page presided. Here it was announced that fifty-four ocean-going ships were provided with wireless, in contrast to only ten the previous year. There was some disappointment expressed by a few shareholders that extensions on a larger scale had not been made, but they were assured of the true fact, that a great deal of time during the past year had been given up to completing foreign contracts.

This was the aspect in which Marconi himself was so greatly concerned. His aim in those days was to establish wireless telegraphy in such a way that it would encircle the globe. His greatest ambition was to see communication established between all parts of the world.

On 6th June Marconi was outward bound for America once more, this time from Queenstown in the *Campania*. He was accompanied by Mr. Maxwell, director of the Cunard Company, who had expressed a special desire to be actually aboard when messages were being transmitted and received.

When they arrived at New York on 11th June, they had witnessed another feat which had never been accomplished before. Not only was a daily newspaper printed aboard from wireless messages received, but the advertising space was sold to manufacturers of popular goods, this being the first time on record that wireless was used for advertising, and might well be described as a forerunner of the "sponsored" radio programme so universal in America and many other countries to-day.

"We had not got very far on our journey," Marconi later described, "when messages commenced to arrive from Seaforth and Poldhu. One message arrived from the American Station at Cape Cod, when the ship was 1,937 miles away from it. Then the *Lucania*, which was on a return journey to England, picked up and transmitted news, and many private messages were exchanged between the two ships at the request of passengers, who enthusiastically welcomed this new method of communicating with their friends in such unusual circumstances."

Marconi did not remain very many days in America, because of his arrangements in connection with the Coltano station, and, as agreed, he returned to his native land at the end of July and opened the station according to schedule.

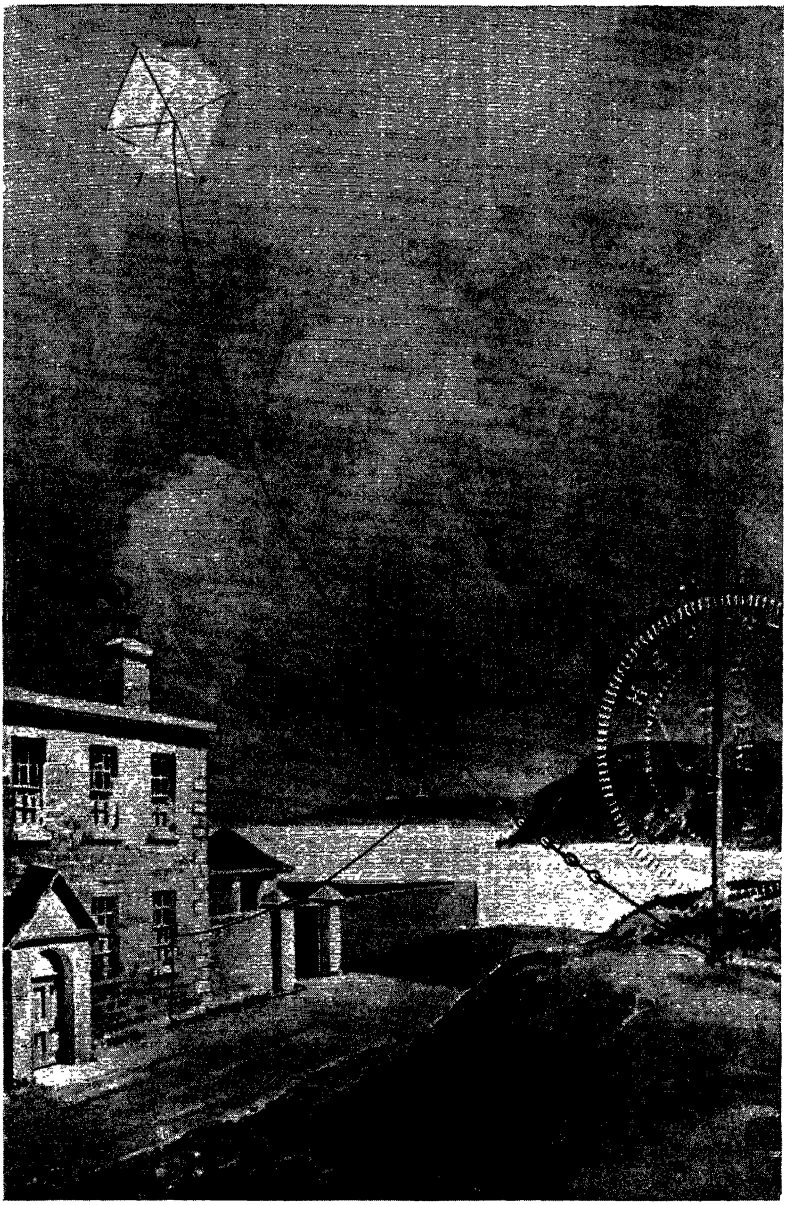
August 3rd, 1904, was a red-letter day in Montenegro; from the early hours of the morning peasants from the surrounding districts had been coming in to Antivari. Almost without exception they were wearing their picturesque national dress, and the quaint narrow streets of the old town echoed with their chatter and laughter.

This was not the usual "festa" day, in honour of a saint, or in thanksgiving for the great plum harvest—it was to celebrate a new wonder—a method of sending messages from one place to another without any visible means. Some of the older people shook their heads in disapproval, it sounded like magic—they would not talk about it, for fear they brought some evil upon themselves.

The fact was that Marconi had been able to announce a few weeks previously that the station at Antivari (Montenegro) had been working satisfactorily for more than a month, and that regular communications were taking place between the station and Bari (Italy).

Now that the stations both at Bari and Antivari were complete and had withstood stringent tests, it was felt that the moment had come for a great inauguration ceremony—hence the atmosphere of gaiety in the streets as the people climbed the hill from which the blue waters of the Adriatic could be seen in the distance.

Prince Nicholas attended the ceremony personally, and insisted on seeing all the details of the station; these were



[*Marconi Wireless Telegraph Co., Ltd.*

ST. JOHN'S, NEWFOUNDLAND. KITE WHICH RECEIVED THE FAMOUS SIGNAL, 1901

explained to him by the inventor. The opening ceremony was also attended by M. Vukovitch, Minister of Foreign Affairs, and the Marquis Cusani, Italian Minister at Cettigne. Marconi made a brief speech amid great enthusiasm, for it was felt that this was a family affair more than a meeting between two friendly countries, because of the Queen of Italy, who, being a Montenegrin Princess, had taken the keenest interest in this new method of linking up the country of her birth with that of her adoption.

Prince Nicholas's first action after the ceremony was to send a telegram to the Czar of Russia, then to the Kings of Italy and Servia, and the Emperor of Austria.

The peasants were still keeping up their holiday, when Marconi returned to Cettigne as the guest of the Prince.

On 10th October a radiographic station was opened at Ushant in France, by the French Government, the main purpose of which was to communicate with ships at sea.

By way of contrast to Europe, we can turn far eastwards for a moment and find that the Italian Government had obtained permission from the Chinese authorities to establish a wireless station in their territory.

During November Marconi was in England again for a short time, and towards the end of this month he wirelessed greetings to his old friend Admiral Mirabello, Minister of Marine Affairs, who had not been in his usual good health for a while.

The Admiral replied from the Government station at Ancona (in Italy) that he was very glad to receive the message and would be happy to see Marconi again before very long.

The Ancona station was a new receiving station for messages from England and it is interesting to recall that by 2nd December, 2,400 words had been received from Poldhu within half an hour, a big increase in speed over that of the previous year.

As the result of arrangements made with the Post Office the Marconi International Marine Communication Company were allowed a charge of 6½d. a word, with a minimum charge of 6s. 6d. per telegram, between ships at sea and the station at Bari.

Any official step of this kind pleased Marconi. Formerly the Post Office had been rather reluctant to acknowledge the

use of wireless. Now it was possible to go into any Post Office, and (if wireless were installed upon the ship) a telegram could be sent to any passenger in the ship. This did a great deal towards interesting the public in radio-telegraphy.

On 16th February, the Annual General Meeting of the Marconi Company was held at River Plate House under the chairmanship of Sir Charles Euan Smith. Mr. O'Brien asked several questions and enquired if information could be given to the shareholders concerning the De Forest litigation. This lawsuit, it was explained in reply, was between the American Wireless Company and the De Forest Company, and did not actually concern themselves (the English Company). As most people will remember the De Forest Company lost their action.

The company was not at that time a profit-earning concern. It was certainly holding its own in most countries, however, and was making strides in maritime use. Messages could be sent to the majority of the Cunard liners in 1905 at any stage on their voyages. It was, in fact, during May of this year that Cunard steamers had communicated with Europe and America simultaneously, a feat which had not been regularly accomplished hitherto.

Canada still continued to forge ahead in the fields of radio-telegraphy, and on 24th March, Lord Strathcona, High Commissioner for Canada, was notified by the Minister of Marine and Fisheries, in Ottawa, that the Canadian Government had decided to place a wireless telegraphy station on Sable Island. This site, it will be recalled, had been visited by Marconi, accompanied by Canadian officials, at an earlier date. Marconi himself says that he considered it a most excellent site.

This station was installed without delay, and was ready for use by the beginning of July, in addition to still another station at Camperdown, Halifax. Two other stations at Whittle Rocks and Cape Rich were not in working order until the end of this month. All these new stations, added to those at Cape Ray, Heath Point, and Fame Point, provided a system of wireless on Canadian and Newfoundland shores, which very greatly assisted the shipping in the St. Lawrence River.

These stations made history and were particularly mentioned at the company meeting which took place the following year on St. Patrick's day, when it was remarked that the newest one had been working night and day for some considerable time, with complete success.

With the object of allowing people to see something of the working of radio-telegraphy, in September, 1905, a wireless exhibition was held at Liège. The Grand Prix of this exhibition was awarded to the apparatus exhibited by the Marconi Company. In England, too, at about the same time, Mr. W. Duddell, M.I.E.E., began a series of weekly lectures on wireless telegraphy, which he illustrated with lantern slides, showing the earliest apparatus, as well as pictures of Hertz and Marconi. These lectures proved very popular, and showed that the interest in wireless and its development was not confined to a few people only.

It was in this year that the agreement which Marconi had made with the Italian Government was due to close. Marconi told the Italian Minister of Post and Telegraphs to consider the agreement as cancelled, in order that they might, if they chose, consider and try out other systems.

Marconi at this period felt keenly the criticisms which were being made in certain quarters, though the great majority of his friends, and all those who had worked with him, remained loyal. The Italian Government's reply arrived promptly. The Minister of Posts and Telegraphs said he was convinced that it was right to put into force a Bill which had been twice approved by Parliament to continue with the Marconi contract as before. The Government, he continued, was fully convinced of the value of existing conditions and was grateful "to the illustrious Italian who so generously offered to his country the use, without compensation, of the extraordinary fruits of his genius."

He concluded with the words: "I beg you not to concern yourself with any discordant opinions, which do not in any way reflect the feeling of this country or the Government." He finally confirmed the opinion of the Italian Government to adopt the Marconi system, and refuse compulsory exchange of messages with other systems.

The year 1906 dawned favourably for Marconi and his

invention. His company was able to announce a profit which was some £4,000 in excess of the previous year, and the legal defeat of the De Forest Company in America had strengthened the position of Marconi's system very considerably. In all the ensuing disputes, there never was any further question of the validity of patents. It was acknowledged at last that when Hertz awakened the world with his discoveries, ten vital years were allowed to elapse before any further progress was made.

Canada continued with further extensions, and in April Mr. Oppé, Manager of the Canadian Marconi Company, signed a contract with the Dominion Government, whereby the country agreed to take over and operate such stations as those on the Labrador coasts. The authorities who dealt with the sealing stations were approached, for it was agreed that if the sealing steamers would equip themselves with wireless apparatus, the company would build stations on the N.E. coast of Newfoundland. A contract was then to be drawn up, admitting all Marconi equipment free of duty for the next ten years.

In February, 1906, an exhibition was held at Milan, and, at the personal request of Admiral Mirabello the first experimental instruments from the Villa Griffone were on view. These caused widespread interest and the exhibition proved a great success. Marconi himself was unable to be present at the exhibition as he was very busy in England with experiments. However, at Admiral Mirabello's request, the Marquis Solari was sent to Poole to see him.

Throughout his career not only those who were his assistants, but all those people who became associated with him, have respected Marconi's wishes; when he made it known that he did not wish to be interrupted, or that he did not wish to see any callers, these requests were obeyed to the letter; it was the outcome of a request of this kind which nearly prevented Solari from seeing the inventor.

The Haven Hotel, Poole, which became a landmark in the history of wireless, was a very ordinary-looking, cream-coloured building, situated almost on the foreshore, with "Haven Hotel" painted on the side and visible for some distance; it looked like thousands of other small seaside

hotels, which are dotted all around the shores of Great Britain. A low stone wall and a thick hedge of evergreen shrubs, separated the small garden of the hotel from the beach. Here, only a very few yards away stood a tall mast and a maze of wires, the only object to be seen to mark the little hotel out as different from its kind. The proprietor in 1906 was a Frenchman, who rather enjoyed having his hotel made famous. He was no exception to the rule which kept Marconi so well protected from intruders, and if it had not been for his small daughter, it is doubtful if the Marquis Solari would have found the inventor.

When he asked: "You have Signor Marconi here?" the Frenchman shook his head, and from the expression on his face, one would have thought that he had never heard of the existence of such a person. "But I have come from Italy to see him—from the Admiral Mirabello." Still the Frenchman pretended not to understand.

It is impossible to say how long the argument might have continued, if a childish voice had not interrupted—the Frenchman's tiny daughter—who exclaimed: "He has promised to have tea with me to-day." Marconi has always possessed the gift of understanding children, one of the few purely Latin characteristics in his disposition.

About this visit to Poole, the Marquis Solari tells a story of how one Sunday a party of girl holiday-makers arrived in a charabanc; they had brought several baskets with them and were soon making preparation for a picnic on the shore.

Marconi and Solari were taking a walk along the coast, and by way of amusing himself, Marconi picked up a tiny handful of pebbles and threw them one by one, aiming at the waves as they broke on the not-far-distant beach. Unfortunately, he did not take very careful aim, and one little pebble slipped down the decolletage of one of the holiday-making maidens. The startled girl jumped up and indignantly tackled Solari, who, unluckily for himself, was smiling at the time. His astonishment in no way abated when he heard the inventor reading him a lecture on deportment for the benefit of the girl. Marconi, however, does not recollect the event.

CHAPTER VII

FIRST TRANSATLANTIC WIRELESS SERVICE

WHEN the year 1906 dawned, it had become obvious that there was a great commercial future for wireless telegraphy. More than this, people who were at all scientifically minded had begun to realize that wireless would have spheres of usefulness not entirely confined to long-distance communication, though the latter aspect was the one which appealed most to the popular taste.

Previous to this date, the outstanding feeling in regard to wireless, with the exception of a few carping critics, was one of admiration for the young man who had shown the world how electric waves could be made to serve mankind.

This year was to witness the beginning of really serious competition and all its attendant troubles.

There were now many who resented the Marconi Company's premier position. The Wireless Telegraphy Bill of 1904 had caused a good deal of comment. Before this Act there had been no Government control of wireless telegraphy, and in the absence of licences, without some protection, the Marconi Company might very well have gone out of business. While the Act of 1904 was being contemplated, there had been a working agreement between Marconi and the Postmaster-General.

It was this working agreement which led to Marconi being accused of having made secret arrangements with the Post Office. Voices now began to raise themselves in opposition to any kind of monopoly. For some years there had been a free field for the Marconi apparatus, which alone had carried out in Great Britain the work of receiving and transmitting for the public, wireless messages and radio telegrams. Lloyd's had expressed the opinion that one system was sufficient and it was generally considered that indiscriminate wireless could become a national danger.

It is not surprising, however, that other people and groups of people should have envied the position of the Marconi Company and determined to establish something on their own; thus we find in 1906 other wireless systems springing up like mushrooms.

There was the German "Telefunken Company," the Braun-Siemens and Slaby-Arco inventions, the National Electric Signalling Company of Washington, U.S.A. (who operated the Fessenden system), the De Forest Wireless Telegraph Company of New York, the Lodge-Muirhead Wireless and General Telegraphic Syndicate. Naturally all these companies hoped to make something out of their activities and were determined to fight to the last ditch against any form of monopoly. It does show the trend of "considered" opinion, to find that no less than sixteen shipping companies had already adopted the Marconi system entirely.

It will be remembered how ten years previously, when Marconi was trying out his earliest experiments in England, a patriotic German—Professor Slaby—had been sent by the Kaiser specially to see the young inventor and find out what he had achieved. Professor Slaby, when he returned to Germany, set up a system of his own and made considerable progress in his own way.

This progress, however, was not considered sufficient by his Royal master, who wanted to see a wireless system emanating from the Fatherland, with world supremacy. With the object of learning more about Marconi's system, the Kaiser ordered that a wireless conference should be held in Berlin in July. However, as things transpired, the conference was twice postponed, and the delegates did not finally assemble until October. The headquarters of the conference was the Kaiserhof Hotel, Berlin, and delegates from twenty-three countries attended, in addition to seven which had been represented at a previous wireless conference, the first ever held. There were eight delegates from England, who included Mr. H. Babington Smith, Secretary of the Post Office, Messrs. J. Gavey and R. J. Mackay and the Hon. A. E. Bethell, Assistant Director of Naval Ordinances.

When the proceedings began on 3rd October, they were conducted privately, not even a few selected pressmen were permitted to attend. Nevertheless, news soon spread abroad that the Germans were violently opposing the so-called Marconi monopoly. There were many wild statements made as to how Professor Slaby and Marconi first met, until it was stated that in the first place Sir William Preece introduced them.

Before many days were over, it was sheer farce to say that the discussions at the conference were in any way private, everyone was talking about them—it was quite obvious, too, that the Germans were failing miserably in their attempt to establish a claim of supremacy for their system over that of Marconi. Every inquiry showed that the Marconi company were far ahead, not only in theory, but in sound commercial application, which naturally counted most among delegates whose number was largely composed of men with business interests.

Yet almost at the same time (12th October), Professor Silvanus P. Thompson, in a letter to *The Times*, complained of the "boost and brag" of the Marconi Company "in order to gain a monopoly."

Professor Thompson also brought up the old argument of how Lodge had proved in 1894 that Hertzian waves could penetrate through stone and he also stated that it was untrue to say that Marconi had not used Hertzian waves. Mr. Edward Sassoon, another who was greatly interested in the future of wireless, urged in the Press the necessity of avoiding anything like international commitments.

Lord Kelvin, always a friend and admirer of Marconi, pointed out in a well-balanced argument all that Lodge and Preece had accomplished. He said that Lodge had transmitted signals over a distance of 150 yards, but they all welcomed Marconi, as definitely the first inventor to have tackled wireless from a commercial view-point.

Still the attacks on Marconi continued. Statements appeared in print to the effect that some £5,000 of taxpayers' money had been spent on experiments for Marconi, nearly ten years earlier on Salisbury Plain. Mr. John Oppé, acting Manager of the Marconi Company, immediately contradicted

this and explained that the Post Office authorities had lent telegraph poles and some other equipment on that occasion, and that the extent of the State's expenditure was, to the best of his knowledge, confined to the payment of fares of the officials who went from London to witness the demonstrations.

That point settled, another was brought forward in Marconi's favour. It was recalled that Professor Slaby had stated on his return to Germany after seeing Marconi's apparatus that "he had seen something quite new." Yet in face of this we have Slaby saying at the Conference that "he owed no debt to the Chevalier Marconi."

In contrast of this we find Dr. Oliver Lodge, despite certain remarks, speaking highly of the way in which Marconi developed wireless telegraphy and enlisted the interest of all. He suggested further at this time that a good deal of what had been said was merely due to misunderstanding.

A proposed clause at the conference was: "*All coast stations and all apparatus on ships shall be obliged to exchange messages without regard to the system of wireless telegraphy which they severally employ.*"

In a letter to the Press, Mr. Neville Maskelyne explains that inter-communication with other systems is perfectly possible. He records that Great Britain is first in the wireless field, and other nations, he says, do not altogether like it.

The conference ended on 31st October, with the agreement that modifications were to be made regarding the reception of messages under other systems. There was to be no international control, but an international bureau was to be set up at Berne which would deal with all further disputes and difficulties. Great Britain, it was easy to see, was in the finest strategic position as regards wireless, and the Marconi system was destined to flourish in spite of, rather than because of, the convention.

It was not until a few months later, with the beginning of 1907, that it was decided that a select committee of the House of Commons should be appointed to consider the results of the Berlin conference. It is an illustration of the absorption of Marconi in his work that he was so little

affected by all these bickerings. He was too busy with the work he had in hand to concern himself with international jealousies. He concentrated on perfecting what had already been done, and in making further improvements.

At this time an official statement was issued showing that in 1906 1,261,000 words were transmitted by ships at sea, as against 783,950 words in 1905. The prospects of the commercial success of wireless telegraphy were beginning to appear more likely. Early in 1907 a member of the Marconi Company went to France to supervise experiments at the island of Porquerelles, near Toulon, the great French Naval base. This was to prove to be an important station. On completion communications were made which extended more than 1,200 miles. Telegrams were received from Poldhu and the messages were decisive and clear.

"It was episodes of this kind which inspired me to redouble my efforts," Marconi has stated. "I could afford, I thought, to pay little attention to the adverse criticisms levelled against both myself and my system."

Yet this was the stage in the development of wireless telegraphy when troubles were due to show themselves, and they could not be ignored. There had been certain differences of opinion between the Canadian Government and the Marconi Company, but Marconi himself was not concerned with these. When questioned by the Canadian Press at the time, he said: "I can say nothing of any trouble between the Company and the Canadian Government, for I am only an employee of the former. But from personal experience I can say that I have always received the warmest encouragement from Sir Wilfrid Laurier and his colleagues. The Federal Authorities have spared no trouble to assist me ever since I came here three years ago."

Marconi left England for a flying visit to Canada to experiment at the long-distance station at Glace Bay with modified apparatus which was the result of recent research work. He was able to communicate with the English coast, using the new apparatus, with greater efficiency, as he had anticipated, and he hurried back to England to install new machinery which would make better and more regular communication. During his visit a tariff of charges was

established at ten cents a word for private messages, and five cents for Press news.

While at Glace Bay Marconi also experimented with an instrument which would enable a steamer caught in a fog to locate the exact position in which it was situated, and enable it to steam ahead at full speed in the Gulf and River of St. Lawrence, by keeping in continual touch with shore stations.

On 14th September, Marconi left Liverpool again for Canada, this time aboard the *Virginian*. He had now a system of tuning which he wished to establish between English and Canadian stations. Already thirty stations were working day and night in Canada and Newfoundland, but a new service was to be opened between Cape Breton and the coast of Galway. Arrangements on the British side were complete. The new Irish station had been installed on a dreary headland some four miles from Clifden in Connemara. Here three hundred acres of Irish bog faced the Atlantic, and after two years of pioneer work on the part of the Marconi Company's staff, this waste had become the site of one of the largest wireless stations in the United Kingdom.

Opinions frequently differ and places do not impress us all in the same way. Most people thought the surrounding country of the Clifden station wild and forbidding; Marconi, commenting upon this description, described it as a typical stretch of Irish scenery—the wildness and loneliness appealed to him; it was the kind of country he liked to ride over in the early hours of the morning—with nothing but the clip-clop of his horse's hoofs and the shrill screams of the sea birds to disturb his thoughts. In later years a horse took the place, with Marconi, of that wonderful bicycle, bought with such care in his early London days, and Ireland always appealed to him because of the opportunities it offered him for solitude.

During the two years which preceded October, 1907, Marconi had put in many a month's work at the Clifden station, which was erected under the auspices of Chief Engineer Entwistle. The aerials at Clifden were installed on a new principle which Marconi had discoveted, and there were other decided improvements in the details of the plant. Glass plate condensers had been replaced by

ones composed of metal plates. The spark system was replaced by a new method. The entire task of organization was by no means inconsiderable. From a purely scientific point of view the Irish station was a great achievement. Everything had been done, as far as was then known, to eliminate the difficulties of the effect of sunlight on transmission, but fresh improvements were continually being incorporated and progress made.

Marconi's visit to Canada on this occasion was destined to be a long one. The fruits of his labours at Clifden were soon made manifest, for on 18th October, 1907, a Press message was sent across the Atlantic without using in any way the telegraph cable.

At Clifden there was great excitement when the first message from Cape Breton was thus received at 9 a.m. This was a formal congratulatory transmission, perfectly received.

During the morning other messages came through and by midday the station bore a most festive air. Crowds of people had gathered, some with scientific interests, others who had come out of curiosity, and others, simple Irish folk, who just came because they had heard there was something going on, which, however, they understood very little about. Flags were flying gaily in the strong Atlantic breeze. English, Canadian and American, with the Italian flag of red, white and green added, out of compliment to the inventor.

Despite this holiday atmosphere, however, secrecy was observed, and no one was admitted to the new plant except those privileged visitors who had a very special pass. The transmission of a "Marconigram" throughout that eventful morning was heralded by a deep booming sound, which sounded even louder as it echoed emptily across that desolate stretch of Irish bog. Flashes of lightning, it seemed to that small group of privileged observers, announced that a message was being despatched in return.

To the *Irish Times* the following message was sent, from Canada, at the hands of the inventor himself:

On the inauguration of Transatlantic Wireless Service, I send the Irish Times cordial greeting. Happy that corresponding European station is situated in Ireland. Marconi.

To the Dublin *Evening Mail*:

In opening regular Transatlantic Wireless Service I am sending my best wishes to the Mail which nine years ago was the first newspaper to utilize wireless telegraphy for practical purposes. Marconi.

The 18th October was a day also of excitement in Ottawa, when the first despatch to Canada by the Marconi Wireless Telegraphy system was received by an Ottawa citizen. The second despatch was published the following morning in in the Toronto *Globe*. This was a message from Lord Strathcona in London. Messages were then exchanged between the Governor-General and King Edward VII, as follows:

Earl Grey to His Majesty the King.
I have the honour to congratulate Your Majesty on the establishment of a fresh link between Canada and the Motherland by the opening to-day to public use of Marconi Wireless Transatlantic Telegraphy. Grey.

H.M. the King to Earl Grey.
I thank you for your telegram. I am delighted that Wireless Transatlantic Telegraphy should unite the bonds between Canada and the Mother Country so closely. Edward R.

In addition to these telegrams, there was one sent by H.M. King Edward to Marconi, which Marconi to-day still has a copy of, and prizes very much. In it the King refers to the days on board the Royal Yacht *Osborne* when he watched the inventor fixing up the installation for the messages to be transmitted and received from Osborne House.

The public service established between Glace Bay and Clifden in October, 1907, was a limited one; only a certain number of messages were permitted, because there were still improvements to be made, but in the following February, 1908, an unlimited service was opened. From that time until it was put out of action during the Irish rebellion, the Clifden station continued to give good service.

On 13th January, 1908, Marconi arrived once again in Liverpool, this time aboard the *Tunisian*. "I was glad to be back in Europe again," he admits, "for the winter had been terribly severe, and Glace Bay was a cold spot. I was thankful to escape the biting winds which encircle the station in the early spring, when the ice floes from the Gulf of St. Lawrence pack into the bay."

On disembarking he was given a popular reception. The opening of this new service between Canada and Ireland had fired the imagination and was particularly a source of excitement to the large Irish population of the Lancashire port. In the eyes of many of these people, Marconi was an Irishman, and woe betide anyone who dared to say otherwise; he would probably have met with a broken head as the price of his indiscretion.

In a brief speech, upon his arrival, Marconi told those who questioned him, that radio-telegraphy was firmly established on a commercial basis. English and American newspapers were already using the service for the transmission and reception of some two thousand words a day. The public, he added, would be able to avail themselves of this service before very long. All his remarks were received enthusiastically, and long newspaper reports appeared the following day.

It was on 3rd February, 1908, that the Marconi Wireless Telegraphy Company announced that they would accept messages from the public. The response was immediate. To many, the idea of speeding words through the air over thousands of miles seemed to touch on romance. Business was brisk as private citizens hastened to send messages to their friends by this new method, whilst business men were fully alive to the uses of the system, in despatching and receiving last-minute orders and instructions.

"A vast field has been opened up by Marconi's genius," said Sir Charles Euan Smith, when he presided at the annual meeting of the Marconi Company that year. The Transatlantic arrangements, he stated, had given complete satisfaction, and the company now owned five hundred and fifty patents. Sir Charles also reminded his listeners that they should not be depressed by criticisms against the new

system. It would be well, he said, for them to recall that cables were actually considered almost useless at first.

As usual Marconi's address to the Company was brief and to the point, but it certainly had an optimistic note.

With the established success of the Irish station, Marconi spent a good deal of his time at Clifden. He was happy among his mother's people, yet he never made a permanent home in Ireland. When in London, he frequently made his headquarters at the Savoy Hotel, and continued to do so for many years afterwards. Real home for him always meant the Villa Griffone at Pontecchio, though he had so little time to go there—Bologna and its surrounding country are still very dear to him. When in London about this time, he was often to be seen walking down the Strand entirely lost in thought.

Few, however, recognized him; there was little, it seemed, to distinguish him from many other neatly dressed men who passed up and down the busy thoroughfare. This seems strange when one recalls how when people knew he was actually at the Savoy, they would wait, sometimes for hours, to see him come out.

His daily post, too, was becoming heavier and was full of communications from people he did not know; this daily "fan" mail has continued ever since. Some of the requests he receives are indeed extraordinary, and even in those days he received many strange letters from all kinds of people.

An Englishwoman from a distant part of the country used to write to him regularly telling him how she looked at his photograph every day, and thought of him, not only as a great pioneer, but a man whom all the world should thank. One day, in place of the customary letter, a photograph arrived. Marconi, thinking that he was about to see the portrait of his unknown admirer, was surprised when he found himself looking at the picture of a baby. A little note explained: "Behold your spiritual son."

Quite a number of letters were (and still are) from schoolboys who wanted to know more about wireless and what Marconi was going to do next. Not a few of these small boys

made him their particular hero and wanted to know all about his hobbies. Did he collect stamps, or moths? On one occasion he received a small box which, when opened, was found to contain two white mice. It probably cost the sender quite a pang to part with them, but this youthful admirer said in a rather incomprehensible letter that they might keep the inventor from feeling lonely when he was at one of his distant stations.

Letters, too, were beginning to arrive from young men, who wanted to know when there would be a career in wireless, what openings there would be, and what money they would be able to earn.

Occasionally Marconi made further enquiries about the writers of such letters if they appeared to be intelligent. He has always been a man willing to give others help when possible.

All his letters, however, were not of such a pleasant or romantic nature. Since the earliest days of wireless there had never been a lack of those disquisitious citizens who attributed their pains and ailments to the introduction of wireless. These martyred sufferers would write ordering him to cease his experiments, declaring that they felt the waves passing through their bodies. Marconi was always troubled by these letters. He could do nothing. It was impossible to convince them of the error of their diagnoses, indeed, to reply at all merely invited abuse on the grand scale.

In 1909, however, Marconi wrote to *The Times*. Some medical periodicals had suggested that certain diseases were the outcome of wireless telegraphy. Nothing so fantastic as injury from wireless waves passing through the body was urged, but it was stated among other things, that operators and others connected with the sending and receiving of messages would suffer from certain eye complaints.

In his letter, Marconi said: "I have no wish to add in any way to the already sorrowful list of occupational diseases. During twelve years of work and tests we have not had to pay a single case of compensation for accident or injury among our workers. My own good health is another illustration even after the very long hours which I have worked."



[*Marconi Wireless Telegraph Co., Ltd.*

MARCONI AT NEWFOUNDLAND, 1901 (WITH APPARATUS USED AT SIGNAL HILL)

While steady progress was being made at Clifden and Glace Bay in the commercialization of Marconi's invention, wireless telegraphy was spreading farther and farther across the world. New stations were being built in Germany, where efforts were still made to "regulate" wireless so that all systems might be included under one system. The Swiss military authorities in 1907 and 1908 established a complete network of stations. On 3rd August, 1908, the first practical application of radio telegraphy in Australia was made.

A special correspondent of the Associated Press was aboard the flagship of the United States Fleet, then on its way to Australia. He sent a wireless message from mid-Pacific through Reuter's Agency in Melbourne announcing the movements and progress of the Fleet. Yet at the time this pioneer step attracted little public attention. Marconi, commenting upon the event at the time, stated that it gave him further confidence that the ambition he had in mind, to link up the entire world, would one day be realized.

During the early autumn of 1908 Marconi was in Canada again, and when he returned to Montreal from Glace Bay, he was able to report sound progress. The duplication of the Atlantic station and its installation was complete, and more powerful apparatus was in the course of construction. It would be finished, he told the Canadian officials, in about three months. He also made a further announcement which pleased his Canadian supporters. He told them that the next development in radio-telegraphy would be an overland system throughout Canada, with intermediate stations.

Marconi always had high hopes of what might be accomplished by wireless in Canada, particularly in winter. With vast stretches of country under deep snow, and normal means of communication most difficult, wireless, he thought, must prove of the greatest importance. He looked ahead to the day when communication with the outposts of the fur traders, and even Arctic settlements, would be general.

While Marconi was in Montreal it was announced by the British General Post Office that out of the tenders offered they had chosen the Marconi Company to erect certain telegraph stations. As the outcome of this arrangement, a wireless station was set up at Bolt Head, near Kingsbridge, the

most southerly point of Devonshire. This new station embodied all the latest improvements which Marconi had introduced. It was also arranged that this station should be capable of dealing with messages for the Channel Islands.

Since the preceding July when the findings of the Radio-Telegraphic Convention came into force, eight stations had been erected by the Marconi Company for dealing with ship-to-shore messages, to be received without selection as to what system might be used. At first it was thought that innovation would affect the Marconi Company's business, but the convention, after most careful consideration, thought otherwise. The Marconi Company then withdrew their objection and co-operated with the Post Office.

At the end of the year the Postmaster-General, on 11th December, visited Exeter with Sir Henry Babington Smith. A dinner-party was given in the evening, at which the mayors of Exeter and Plymouth were guests. Radio telegrams were exchanged, these being sent by wire to the Lizard and then by wireless to Bolt Head. The first from Marconi read:

H.M.'s P.M.G., Bolt Head Wireless Station. Congratulations on inauguration of Bolt Head Radio Telegraphic Station and best wishes for success of Post Office Wireless Telegram. G. Marconi.

Mr. Sydney Buxton replied by the same means:

Many thanks for good wishes conveyed in your message. The station has been equipped by your company in a most efficient manner. Sydney Buxton, P.M.G.

Despite the German attitude towards Marconi's invention, in February, 1909, the Norddeutscher-Lloyd Shipping Company had given orders that nine of their ships were to be equipped with his system of wireless telegraphy. Later that month the White Star Line asked for further installations, and the Hydrographic Department of the Brazilian Government ordered more apparatus to be sent out to South America. In May contracts were concluded between the Marconi Company and the P. & O. Steam Packet Company,

and at the same time the Royal Mail Steam Packet Company ordered five of their "A" boats to be equipped with wireless.

In August, Marconi received news that the Russian military authorities had been holding trials between St. Petersburgh and Sevastopol, a distance of 1,900 miles, and that so satisfactory had these tests proved that arrangements had been made for a station to be erected. Wireless had become in France so developed that Poincaré had at this time just ordered a Bill to be drawn up to ensure that all wireless apparatus must be authorized by the Government before it could be set up for use.

When Marconi left on 14th September, for America, arrangements with the Post Office had been made for six stations to be completed in this country. The agreement had been completed between the Marconi International Marine Communication Company and the Postmaster-General, and it provided that, in consideration of a payment of £15,000 to the Company, they were to transfer to the Post Office the coast stations in the United Kingdom, previously owned by the International Company, for communication with ships at sea; the latter company thus surrendered the rights which they enjoyed under the 1904 agreement as regards licenses and some other facilities.

The Marconi Wireless Telegraphy Company was interested principally as a shareholder. The Post Office had in future the right to and free use of, all existing Marconi patents, as well as future improvements and patents for the ensuing fourteen years. No station belonging to the Marconi Wireless Telegraphy Company was included in this agreement. Neither did it affect the Transatlantic stations at Poldhu and Clifden; in brief, it made no difference at all to any of the trans-oceanic business.

This control by the Post Office of coast wireless stations may not have seemed a very important affair at the time, but this control which they gained in 1909 was the origin of the vast ramification of the system of radio licences to-day, which affect the rights of millions of listeners to radio programmes.

People, too, were beginning to consider fresh applications of the invention. For example, at this time Captain

Scott was about to set out upon his ill-fated expedition to the Antarctic (his ship, the *Terra Nova*, did not leave England until June, 1910, but plans for his departure had been taking place for nearly a year). Marconi was asked if it would be practicable to use wireless in connection with the expedition. Marconi admitted that it would be quite feasible. "The apparatus," he said, "would weight about ½-cwt., and as poles could not be set up, kites would be necessary to elevate the wires." Communications, he reckoned, could be carried on in this way over a distance of about two hundred miles.

Marconi and Captain Scott met on several occasions, and each man's liking was mutual. "We talked a good deal about wireless and particularly how it might be utilized in the Arctic and Antarctic, but Scott did not take any wireless apparatus with him. Why this was I do not remember now," said Marconi recently.

In contrast to this expedition Commander Peary, the American explorer, took a wireless outfit with him when he made his famous expedition in 1909—the news of his success in reaching the North Pole was received in the United States by a wireless telegraph message sent from Indian Harbour, Labrador. "Stars and Stripes nailed to the North Pole," were the words it contained. The *New York Times* received the messages by the same means. "I found the Pole, I reached it on April 6th, 1909."

Actually the second message from Peary was a wireless which he sent to Herbert Bridgman, Secretary of the Arctic Club of America. "Pole reached, Roosevelt safe." The *Roosevelt* was, of course, the ship in which he sailed from America.

The interest which these messages aroused led to a movement to make wireless compulsory on all ships. Point was added to this movement when the liner *Waratah* was reported missing. It was considered that had the ill-fated vessel been equipped with wireless she would have been found. At this time, too, the world found its first "wireless hero." An operator, Mr. G. C. Eccles, of the *Ohio*, died at his post, while saving the lives of 128 people. His body was recovered and he was buried with honours in Canada.

When on 14th September, 1909, Marconi arrived in

America, to supervise progress at the Glace Bay station, great enthusiasm was shown. He was always received by the Press in great numbers, for he was, indeed, "news." Sometimes he would talk frankly to them; at other times he had nothing of importance to say, and said, accordingly, nothing. He disliked both exaggeration and mystery, and would never talk about an experiment until it was either a success or a failure. When Marconi spoke to the Press he liked to be reported accurately, but it was seldom that his wish was carried out.

On this occasion the demand for news was urgent, and competition was keen. A concerted question was fired at Marconi in the following terms.

"What would you have done if you had been very poor? Do you think you would have struggled on with your invention in the early days?"

Marconi gave the wrong answer. "In those circumstances," he said, "I do not know whether I should have invented anything at all. If so, I am not at all sure I should have persevered."

"Would you have starved for wireless?" they asked, when they had recovered from this unheard of departure from the routine of good interviewing. There was, they thought, still hope.

"I have too good an appetite for that," he told them. And after a pause, it became clear that there were no more questions.

In America, perhaps even more than England, people admired the ease with which he spoke English, Italian and French. In America, too, his simple tastes puzzled the newspapers. He was fond of hunting, probably due to his Irish ancestry, and in fact, preferred the rough going in Ireland to the easier country-side of England. Cycling was another favourite pastime, and it is an undoubted fact that he spent much of his brief leisure pedalling along Irish, American, and Italian country roads on a bicycle.

"I could ride along quietly," he tried to explain to the American Press, "and enjoy the country-side, getting exercise and at the same time having a chance to think."

One can well imagine that American Press men were

not at all pleased with such a simple explanation as this, it was definitely a "poor" story. One reporter, however, rather more enterprising or perhaps merely luckier than the others, discovered that Marconi on some of his rides had been accompanied by no less important a person than the President's daughter, Miss Alice Roosevelt, who was also a keen cyclist. This was a "story," and the American Press made the most of it, much to the amusement of both Princess Alice, as she was popularly called, and Marconi.

President Theodore Roosevelt was keenly interested in Marconi's experiments, and whenever the young inventor was in America he was a frequent guest at the "White House."

In October the Admiralty decided to erect a wireless station at Wick, and later in the month the Bombay radio station established communication with the P. & O. boat *Mantua*, thereby beginning a new era in the history of Indian communications.

On 15th November, 1909, the Nobel Prize for Physics was awarded to Marconi, then thirty-five years old, jointly with Professor Ferdinand Braun, of Strassburg.

The year was remarkable for several new uses of wireless telegraphy. This being particularly true of sporting events. For instance on 20th July, Mr. Hubert Latham failed in his first attempt to win the £1,000 offered by the *Daily Mail* to the first man who succeeded in flying the Channel. A feat which was, of course, afterwards achieved by Mons. Bleriot.

From the Marconi station at the Lord Warden Hotel, Dover, the whole story of this event was told in a series of short vivid messages which were sent by wireless.

To begin with, the wireless installation on the roof of the sheds wirelessed the start to Dover, and the booming of the gun showed how promptly the message had been received. At 8.38 the president of the Chamber of Commerce received the message that Latham had fallen in the sea.

Messages followed.

H.M.S. Halcyon to Marconi Station Lord Warden Hotel. 9.10 *a.m.*

Have you lost touch of aeroplane? Do you want us to look for it?

Marconi Station to H.M.S. Halcyon. 9.15 *a.m.*

Tug has aeroplane in tow. Many thanks for kind offers of assistance. Are you the Fisheries cruiser?

H.M.S. *Halcyon* replied "Yes, many thanks," and finally, from Sangatte, at 10.23 a.m., came the message: "Latham is safe at Calais. Machine damaged."

Also during this year a game of chess was played by wireless, between players on separate ships, the moves being made by instructions received through the air.

The concluding achievement of this year of eventful progress was the invention of the wireless telephone.

CHAPTER VIII

THE "TITANIC" DISASTER

THE year 1910 marked a notable widening in the scope of progress of wireless telegraphy. At this time expansion began which was to carry the invention, originating humbly in those two attic rooms at the Villa Griffone, to the degree of universal utility it has reached to-day, when the lowliest of cottagers may listen with the greatest in the land to a common source of entertainment, education, and information.

It was also in 1910 that Mr. Godfrey Isaacs was appointed Managing Director of the Marconi Company, and on his appointment took up the proposal for Imperial Wireless Communication with characteristic energy, thereby unwittingly opening the way for all that argument and litigation which came to be known (most unfairly) as the Marconi "scandals."

This year, too, Mr. Thorne Baker was destined to make his attempt to send photographs by means of wireless telegraphy. A large number of accidents at sea were to prove the worth of the Marconi system to an ever-widening public.

A murderer escaping by liner to America was to be identified and apprehended by wireless. During the fourteen years which had elapsed since the inventor came to London, wireless had ceased to be a novelty, and Marconi's invention was indeed well on its way to world-wide acclaim. The year opened with the decision on the part of the New Zealand Government to link up their main towns by radio-telegraphy, and the Minister, Sir Joseph Ward, made an important statement on the subject. On 8th April, a wireless message was received in New Zealand from Australia, for the first time in history—a distance of 1,200 miles. On 5th February, the steamer *Alamo* successfully rescued the entire crew, consisting

of forty-six men, from the *Alaska*; and the Pacific liner *Kentucky*, on her first voyage to the Pacific ports from New York, startled the world with a message that she was sinking fast. Through that wireless message not a life aboard the sinking vessel was lost. Again in April, the North Pacific Company's steamer *Santa Clara* sank four miles off Eureka, California, and once more Marconi's invention proved a saver of human lives, for a tug was summoned by wireless and all fifty passengers and crew were saved. Less than a week later the liner *Minnehaha* went ashore on Scilly Rock, near Bryher. The wireless operator communicated with Falmouth and tugs were at once sent to their rescue, and loss of life was successfully avoided.

In contrast, in April, 1910, four stalls were booked for a performance of Maeterlinck's *Bluebird* at the Haymarket Theatre by passengers on board a Cunard liner when they were in mid-Atlantic.

With the opening of the year Marconi was busy with a task that was near to his heart. The great Glace Bay station had been destroyed by fire the previous August; the cause it was thought was a spark on woodwork which had become very dry during the hot summer weather, and he was actively engaged with his faithful assistants rebuilding. He spent two very busy months superintending the construction of this great power station. Marconi had a deep and sentimental attachment to this place.

It was a landmark to fishermen for many miles around. Cape Breton is separated from the Nova Scotian peninsula by the Strait of Canso, and the station eighty feet above the sea level is a bleak spot indeed. Many mornings when the sun rose its light was caught in the thousands of gleaming icicles which hung from the masts. For Marconi they were an inspiring sight as they changed from one opal hue to another.

The operating building was an unpretentious wooden structure, with little to show that it was any different from an ordinary wooden cottage except for the wires which, trailing from the lofty masts, were attached to special insulators inserted into the walls. Actually, of course, the transmission of wireless telegraphy signals is not different from that of transmission by cable except that the wireless

operator with every motion of his hand is at a distance controlling a large amount of energy. At Glace Bay the machinery for generating the electrical energy for transmission and reception was contained in three buildings set in a straight line with each other. On the west side of the station was installed the new power house containing the recently installed new machinery. At the same time the station at Clifden was thoroughly overhauled and equipped with the latest radio-telegraphy instruments.

On 23rd April, 1910, public messages were once more accepted for transatlantic transmission. Lord Strathcona sent a "Marconigram" to Sir Wilfrid Laurier, Prime Minister of Canada in the following terms:

At the suggestion of the Marconi Wireless Telegraphy Company I gladly take this opportunity of congratulating Canada through you on the inauguration of their transatlantic service, which as they represent promises a new era in telegraphic communication between the Mother Country and the Dominions.

News of the death of Edward VII was sent to Canada by wireless telegraphy, and this news was also received on the yacht *Enchantress* by the First Lord of the Admiralty, Mr. Winston Churchill.

On 25th May Marconi arrived at Queenstown from America, full of enthusiasm. He was less reticent than usual and it is recorded that he told the journalists who met him that, "Nation would be in touch with nation as never had been previously."

The annual meeting of the Marconi Wireless Telegraphy Company was held on 29th June, at the Hotel Metropole. Here Commendatore Marconi in his speech said that the fire at Glace Bay must not be looked on as entirely evil; it was, he thought, a case where misfortune would lead to good fortune. During the period of reconstruction, a great many excellent lessons had been learnt. "The progress," he said, "may have been slow, but we have had difficulties to overcome." Difficulties there had been, indeed, on that bleak cliff-top, but they had been overcome by Marconi in the same determined manner as those early difficulties about

which Edison remarked: "If Marconi says he can do it—he will do it," and it was in this same spirit that the station had been rebuilt.

Those shareholders present who took a scientific interest in wireless were interested to hear about some of the interesting features which had been included in the new plant installed at Glace Bay. High tension direct current was being employed for charging the condensers, which did away with the need for alternators and transformers. Special high tension direct current generators had been installed, Marconi told them, to charge a high tension battery of accumulators and charging and discharging arrangements were planned to enable different voltages to be obtained. Up to date no great difficulty had been encountered in regard to either the maintenance or the insulation of this very high tension.

With the appointment of Mr. Godfrey Isaacs as Joint Managing Director, Marconi had more time for technical affairs, which was what he preferred. His energy at that time seemed inexhaustible, he habitually worked sixteen hours a day, and yet found time to keep in touch with most things of importance which were taking place in the world. For instance, Marconi was deeply interested in early flying; not only did he follow the progress made by the early pioneers with enthusiasm, but he did a good deal of flying himself, both in England and in Italy, where a number of Italian naval officers were playing the part of aviation pioneers. It was reported in 1910 that Marconi had bought an aeroplane for his own use, but, like many other stories about the inventor, this had no foundation on fact.

Marconi's announcement that it would not be long before every British possession was linked by wireless had good support in 1910. It will be remembered that wireless did not make much headway in South Africa during the Boer War, which caused some disappointment. Mr. R. N. Vyvyan, a member of the Marconi Company staff, describes in his book "Wireless Over Thirty Years" how he obtained Marconi's consent to visit South Africa at his own expense, with the proviso that if he succeeded in getting an order for the provision of wireless stations while he was there

his expenses would be paid. Upon his arrival he found that an article which he had written about Imperial Wireless Communications, and which had appeared in *The Times* in 1908 had been reproduced in South Africa, which, he explains, simplified his mission. General Smuts and General Botha were both enthusiastic, particularly, as they said, because the introduction of wireless would draw more closely the bonds of the Empire.

In June, 1910, the first Marconi station was erected in South Africa, at Durban. Its range of useful operation was supposed to be three hundred miles, but soon after its completion, communication was established with the S.S. *Zealandia* more than a thousand miles away.

Marconi experienced a genuine grief about this time in the death of Sir Charles Euan Smith, who had presided at so many Marconi Company meetings and who had been from the first an enthusiastic believer in the future of wireless telegraphy.

Public interest of a kind new in the wireless world was thoroughly roused over the part played by this new system of communication through space, when, in the Crippen case, the police used wireless in the ends of justice. It will be recalled how Crippen and Miss Le Neve escaped out of the country, the latter disguised as a youth. Through the wireless operators in the ship the Captain was in touch with the English police throughout the journey to New York reporting every action of the wanted man, with the result that the fugitives were arrested when about to land. It was fully realized that had it not been for wireless, they would probably have escaped successfully.

Despite all these achievements, Marconi himself was by no means content, the desire for much greater conquests was strong within him. "Every success which I or my assistants had always taught us something, sometimes a great deal," he says, but he adds: "We also found there was even more to learn than we anticipated; in science the solving of one problem so often means that there are two new ones awaiting solution." It was then with the idea of making new discoveries that Marconi sailed for Buenos Aires, in the Italian ship *Principessa Mafalda*. During the voyage messages were

received from Glace Bay in Canada, and Clifden in Ireland, quite distinctly over a distance of 3,500 miles by day and 6,000 by night. Greater distances would have been achieved had it not been for the abnormally high wind, which would not allow kites to fly as high as they should have done.

An interesting story of this voyage is told by Capt. H. J. Round, who first met Marconi in 1903 (and accompanied W. W. Bradfield to the States shortly after that date), and worked with Marconi from 1908 to 1914. "It was the most fascinating journey I ever had with him," he says, describing the voyage. "We flew kites from the ship whenever the wind would allow us, usually up to a height of 6,000 ft., but the losses in kites were rather serious. Launching a kite from a ship is no easy matter. I remember once spending nearly two hours trying to get one up when the wind was unfavourable and finally giving it up. G.M. (for that was what we called Marconi among ourselves) came along presently and suggested that he should try his luck, remarking that some people did not know how to do it. Much to everyone's surprise, he launched the kite with ease, and it was some time before I discovered he had arranged with the skipper to alter the course of the ship sufficiently to give a launching wind."

It is from Capt. Round, too, that the most vivid description comes, of the struggle which took place at Beunos Aires to get the kite launched. It took them nearly a fortnight. When at last success rewarded their efforts, the most awful atmospherics imaginable could be heard. To use Captain Round's own words: "Our Fleming valves glowed blue with them." Anyway both Clifden and Glace Bay were heard quite clearly, in addition to other stations.

These experiments carried out in the *Principessa Mafalda* were of great importance, if only for the following reason; they showed that the difficulties over a long distance in sunlight could be overcome. As a matter of fact, these tests had a far-reaching effect, and one tangible result was the arrangements which were made, before Marconi left Buenos Aires, for the erection of a high-power station at Punta del Este in Uruguay.

About a year later this station was working well, for on

14th January, 1911, it was reported that a wireless message had been received at Liverpool from Punta Arenas—a distance of 7,300 miles.

Litigation came to harass the Marconi interests with the close of 1910. In the High Court of Justice in London, the British Marconi Companies and others sued the British Radio Telegraph and Telephone Company for the infringement of patents. Three patents were described and discussed in Court, the already famous 7777 of 1900 and two others of 1902 and 1907. In March, 1911, judgment was given in favour of Marconi. There was a rather unusual interest attached to this case, as it was the first time that wireless apparatus had ever been erected in any Court of Law. Special permission had to be obtained from His Majesty's Office of Works, before the huge apparatus could be taken into Court and fixed on a platform which had been erected over the Press reporters' box. Permission had also to be obtained to tap the Law Courts' electricity supply in order to carry out the demonstrations which the Marconi Company thought essential, if they were to explain their points in a comprehensive manner. The constant buzzing of the apparatus when demonstrations were being carried out and the violet coloured flame which illuminated the court, must certainly have added a note of originality to the entire proceedings.

At this juncture it is also interesting to recall that just a year later, it was announced that the Marconi Company of America had been successful in an action against the United Wireless Company and Clyde Steamship Company. This action which had begun a year previously and was actually a test action, was for the infringement of the American patent which corresponded to the famous 7777, the master-patent covering the principle of syntonization and selectivity.

Both defendants in these actions admitted the validity of the patents, admitted their infringement and submitted to judgment and a permanent injunction in favour of the Marconi Company.

The decision of the High Court practically doubled the shore-to-ship business of the Marconi Companies. There were some five hundred ship installations and seventy land stations, which had been erected and worked by the United

Wireless Telegraph Company, and now passed into the hands of the Marconi Company. The Clyde Steamship Company was a comparatively small company, selected for this reason to make a test case. All ships fitted by the United Wireless Company, some of which were English, were affected by the decision.

Another effect of these decisions was to confirm the judgment given by Mr. Justice Parker in the action brought by the English Company against the British Radio Telegraph and Telephone Company, upholding the 7777 patent. The claim was thus firmly established which made for the priority of Marconi's invention in all the essential features of successful telegraphy. Just before the Anglian case was settled another controversy was amicably arranged, though in rather a different manner. In January, 1911, the Marconi Company came to an arrangement with the Compagnie de Telegraphie sans Fils of Brussels. This firm was licensee for the Marconi patents in Germany, so that when this arrangement came into force the competition which had hitherto existed between the German Telefunken system and the Marconi Company ceased.

The end of 1910 brought the usual shipping news, showing how loss of life at sea was being reduced by the ever-extending use of wireless. On 17th December, one hundred and six persons were rescued from the s.s. *Olympia* of the Alaska Steam Ship Co. The *Olympia* went ashore on Sea Island in Prince William Sound, after having been violently buffeted about in a storm for several days. Hayes, the wireless operator, kept sending distress signals which were finally picked up by the *Cordova*, which was able to rescue the entire crew unharmed, though suffering terribly from exhaustion.

Another maritime event, of a more cheerful type, was the voyage made by the *Mauretania*. She accomplished a return transatlantic trip in twelve days, despite the terrific weather she encountered and was able to keep in touch with land by means of her wireless installation.

Business at this time was keeping Marconi so much in England, that he had little opportunity for spending any time in his Italian home. For such reasons he decided to make his home at Richmond, near London. He lived for

many months in the beautiful old house he rented, which was known as the "Old Palace" because it had once formed part of the old Tudor Palace at Richmond, which in the 17th century was said to have covered ten acres of ground. During his stay there he travelled to and fro to London daily by car. However, he was not destined to enjoy the permanence of a home for very long; constant changes of residence were necessary for his work, and, indeed, the greater part of his life has been spent in travel.

It was not until after the War that he decided to live as much as possible at sea.

It might have been thought that by 1911, fifteen years after its first use, people would have become sufficiently familiar with wireless telegraphy not to blame it for conditions with which it could not possibly be concerned. Yet we have at this date a serious publication suggesting that certain dental troubles were due to "excessive meat eating—and wireless waves," almost at the same time an estimate was published showing that more than 3,000 lives had already been saved through wireless telegraphy.

An outstanding event in the contemporary progress of the Company was when the India Office concluded a contract with the Company for the erection of stations at Calcutta, Delhi, Allahabad, and Simla. These, it was said at the time, were to be used primarily for military purposes. Another warlike aspect of wireless telegraphy was the series of experiments carried out aboard the *Vernon* at the Naval Torpedo School at Portsmouth. These were with a view to the adaption of wireless telegraphy for naval airships.

It was in April, 1911, that an announcement of vast importance was made, linking up the general progress of wireless telegraphy towards a specialized end. Mr. Thorne Baker surprised the world by declaring that music could be transmitted by wireless. Experiments were carried out between Brussels and Slough, and a few bars of "God Save the King" were effectively transmitted.

On the heels of this achievement came the news that at the Imperial Wireless Conference it had been decided that the Government thought there should be a chain of stations erected throughout the Empire.



[*Marconi Wireless Telegraph Co., Ltd.*

DURING A WINTER AT GLACE BAY

(*Left to right*) G. S. Kemp, R. N. Vyvyan, Marconi, P. W. Paget, F. Stacey, F. W. Taylor

Marconi shares rose high in the financial markets.

On 21st October, the Marconi Telegraph Company took over all the Lodge-Muirhead patents, and Sir Oliver Lodge then became associated with the Marconi Company as scientific adviser. Law suits were not, however, entirely finished with, for the Company's next step was to issue a writ against Messrs. Siemens Bros. for an alleged infringement of their patents. A great Italian event of this time was the completion of the high-power station at Coltano, near San Rossore, where the King of Italy had a country estate. This station at an early date was able to communicate with Africa. When Marconi arrived in Italy to inspect the working of the station he travelled by car to the King's estate where he had been invited to stay.

Before the formal opening of the station, Marconi wished to communicate with Clifden and Glace Bay. He sent a telegram to these stations asking them to be prepared to receive messages at a certain time. Later in the day he received a reply saying that messages had been received which, however, were unintelligible owing to a severe storm which was raging. It was decided to send further messages to Clifden at 4 p.m. and this time a favourable reply was received. "Your signals are strong and readable."

In reply to a telegram sent by the Minister of Posts and Telegraphs, the answer read: *I thank you for your kind telegram, which I will make a point of communicating to-day to my colleagues of the Cabinet. The intimation that Coltano is now able to transmit and receive news from your English and Canadian Stations will be as much appreciated by my colleagues as it will by the whole country.*

The Managing Director of the English Marconi Wireless Telegraph Company sent the first Marconigram *via* Clifden and Coltano to Queen Margherita: this was to convey their congratulations on the occasion of her birthday. For the special inauguration of the station Marconi decided to communicate simultaneously with the station at Massowah in Africa and with Glace Bay, Canada; and on 19th Nov., 1911, it was arranged that the King of Italy should pay the station a visit.

Just as the King was due to arrive it was noticed that one

of the wooden masts on the top of the high towers, more than seventy feet high had caught fire. A sailor, with the agility of a cat, climbed the mast and holding on to the rigging with his legs beat out the smoking antennae.

At that moment the car with the King and his aide-de-camp arrived. Marconi hurried to meet his Royal guest, who had scarcely got out of his car when a message came through from the African Station at Massowah,* which turned out to be one of welcome and congratulation to His Majesty.

In the receiving-room was Franklin, Marconi's able assistant who had arranged the apparatus in such a way that it was possible to receive messages from England, America, and Africa at the same time. In the centre of the room was a table on which the King saw the apparatus for reception. Marconi proceeded to explain all about the electrical circuit and how the messages were received, while the King listened with the greatest interest. Desirous of seeing further experiments, he studied the apparatus more closely. Franklin suggested that the King should try for himself, and offered a telephone head-piece. The King placed the apparatus to his ears, then Franklin placed his hand by the great induction bobbin. The King was able to hear the signal from Canada quite plainly when Franklin's hand was near the bobbin but he found that signals faded when he withdrew his hand.

The King regarded Marconi with a questioning expression. The inventor was explaining that proximity of the human body will make a difference in the oscillation period of the circuit when a message began to come through. It read: *The directors of the Canadian Marconi Company send their humblest homages. Glace Bay.*

The King read the telegram for a moment, then looked up at Marconi. Still he did not speak, but gripped him by the hand. It was thus in a moment of silence that the great station of Coltano was really opened.

With the expansion of business which was taking place on every side, the Marconi Company in London rapidly outgrew the accommodation of its offices. At this time it had become clear that the limit had been reached, and other premises to house the ever-growing staff were sought. Finally

* In the Italian Colony in Abyssinia.

the directors decided to make an offer for the lease of the old Gaiety Restaurant in the Strand, and, if negotiations were successful, to rebuild the restaurant premises for use as the central headquarters of the company.

A review of the offices used by the company in London reveals graphically the phenomenal growth of Marconi's invention on its surrender to the world of commercial exploitation. First of all in the beginning there was a modest suite of rooms in Mark Lane; these were abandoned for larger offices in Finch Lane, near the Stock Exchange: the annual meetings were then held at some hotel or in public rooms. Watergate House, Adelphi, followed, extending from a suite of offices to the occupation of two floors, and then to the entire building. When even this would not suffice, additional offices were rented in Durham House. And now another move was due.

A committee of the London County Council recommended that the Marconi Company's offer of £6,500 a year should be accepted for the restaurant, and work began at once in rebuilding the famous bar and two hundred rooms. On 16th May, 1912, Marconi House (as the building had been named) was formally opened. Marconi's own offices were on the fourth floor, facing the Strand, next to those of the secretary and the patents department, an arrangement which was carried out again many years later when the company moved their offices in 1933 to the newly built Electra House on the Victoria Embankment. At Marconi House, as at Electra House to-day, one of the most interesting features to visitors is the group of early instruments, used in the first wireless telegraphy experiments, kept carefully in glass cases.

Successful litigation marked this period. The company were successful in an action against a large Wireless Company of the U.S.A., and in February, 1912, the Marconi Company brought an action in the High Court against the Commonwealth of Australia, under the Patents Act, 1903—for alleged infringements of the Marconi patents in the six states of the Commonwealth.

The Judicial Committee of the Privy Council dismissed the Australian Government's petition for leave to appeal against the decision of the High Court of Australia making

an order for the inspection by the Marconi Co. of the Wireless Telegraph plant installed in the Commonwealth stations. This petition was heard in London on 4th July, by the Lord Chancellor, Lord Dunedin, and Lord Atkinson, and at the close of the arguments for the Commonwealth, leave of appeal was refused without calling upon counsel for the Marconi Company.

The first experiments in which wireless telegraphy was applied to aviation were carried out in April, 1912. This was an aspect which interested Marconi very much, for he had a firm belief in the future of aviation, both in peace and war. But the year was notable for a great disaster which undoubtedly did much to establish the value of wireless telegraphy in the public estimation.

On her maiden voyage the White Star Liner *Titanic* (then the largest ship afloat) upon which Marconi had booked a return passage from New York, sank in collision with an iceberg on Sunday night, 14th April. The first news of the disaster to reach the New York Offices of the White Star Company, were communicated to them by wireless by the Captain of the *Olympic*, one of the liners which had raced to the *Titanic's* aid immediately after her first wireless calls for help.

Actually the wireless station at Cape Race was the first to pick up the call for help. Shortly afterwards the Allan liner *Virginian* heard the call and was speeding towards the *Titanic*. The *Virginian* actually reached the sinking ship at almost the same time as two other ships which had also heard and answered the call—the *Parisian* and the *Carpathia*. The *Baltic* also raced to her help. Afterwards it transpired that a Cardiff ship was only thirty miles away from the *Titanic* at the time of the collision.

There was an exceptionally powerful wireless installation on board the *Titanic* in charge of John George Phillips, of Goldalming, Surrey, who, though only twenty-five, was a first-class operator. He had formerly served as a telegraphist in Goldalming Post Office. After the event it was estimated that wireless telegraphy was the means of saving 700 lives on the *Titanic* and the American Government lost no time in speeding up the installation of further stations. Yet, at the

time, considerable trouble was caused following an enquiry into the actual messages sent and received by wireless at the time of the disaster.

A committee of the United States Senate was delegated to investigate the loss of the *Titanic*. During these proceedings, Marconi was called and questioned regarding a message sent from New York to the wireless operators in the *Carpathia*, asking them to "hold the news," when they reached port in consideration of a very large sum of money. Marconi said he was informed this message had been sent by Mr. Sammis, Chief Engineer of the Marconi system in New York, but that he knew nothing about it until afterwards. Questions were put regarding methods of giving the alarm, operator's pay, and so on. Then: "Did you," he was asked "have any communication with Cape Race on Sunday, 14th April, or on any day up to the arrival of the *Carpathia* at New York?"

"I had no direct communication," he replied. "I telephoned to my office frequently on those days. I urged that every means should be tried to get news of the disaster. On boarding the *Carpathia* I went straight to the wireless room and congratulated Mr. Bride (the second operator on the *Titanic*). Mr. Cottom, the *Carpathia's* operator, was not there. He rang me up later and asked whether he might give out a report of the wreck. I told him he might in the circumstances. There is an ironclad rule of the company's regulations prohibiting operators from acting as reporters. Under British law it is a penal offence for an operator to send out information on his own initiative. This is probably why there were no reports coming from the *Carpathia* on her way to New York."

"Did you send a wireless telegram," he was asked, "to the operator on the *Carpathia*, telling him to meet you and Mr. Sammis at the Strand Hotel and keep his mouth shut?"

"I did not," was Marconi's emphatic denial.

A series of telegrams were then read out by Senator Smith, which Marconi stated he never authorized. He also determinedly maintained that he had not ordered any news to be suppressed, but admitted that he had told the operator that he could receive money for a personal "story" after landing. "I knew," he added, "that newspaper reporters would be so

much interested that they would pay for personal experiences, apart from any general news which naturally would not be withheld." He said that he thought that the operator on the *Carpathia* might have used his own judgment and sent an earlier story of the disaster. He has always been utterly opposed to the suppression of any news or the sale of exclusive news.

To the suggestion that his company had laid plans to get the monopoly of horror stories, Marconi replied, "We should have got that in any case because the operators both of the *Titanic* and *Carpathia* were Marconi men."

Mr. Cottom, the wireless operator of the *Carpathia*, was recalled. He said that when he arrived in New York, he went to the Strand Hotel, but he could not find Mr. Marconi or anyone connected with the company. He waited about the hotel for an hour or so, then he rang up Mr. Marconi. He sold his "story," but had not yet received anything for it. He only talked to a reporter.

Later it was admitted that there was some ill-feeling between Marconi operators and those of other systems, and certainly, looking back after a period of years, it is clear that a strong element of jealousy existed in many places. It was a tribute to Marconi's singleness of purpose and sincerity that these attempts to injure his character and blacken his motives failed. Despite all this unpleasantness, he arrived at Plymouth prepared to give evidence on the general working of wireless in the *Titanic* disaster before an English enquiry. But he found a different attitude in Great Britain. The epic story of Phillips, the Marconi operator, was fresh in the public mind. In the words of his fellow-operator it made a moving appeal to English sensibilities.

"There was a great scramble aft, and how Phillips worked through it I don't know . . . Phillips told me the wireless was growing weaker . . . the Captain told us that the engine-rooms were taking in water and that the dynamos might not last much longer. . . . We picked up the *Olympic* and told her we were sinking fast. As Phillips was sending that message I strapped the life belt to his back and wondered if I could get him into his boots. He suggested that I should look out and see if all the people were in the boats. After

seeing a scramble for the last boat I returned and told him 'the last raft had gone,' when the Captain's message came :

" 'Men you have done your full duty. You can do no more. Abandon your cabin now. It is every man for himself. You look out for yourselves, I release you.' I looked out and the boat deck was awash. Phillips clung on, sending for nearly fifteen minutes after the Captain had released us. Our cabin was deep in water. I went back to my room to get Phillips's money for him. I looked and saw someone leaning over Phillips from behind. He was slipping the life belt off his back, and Phillips was too busy to notice what was being done to him. Suddenly I felt a passion not to let that man die a decent death. I think we finished him. From aft still came the sound of the band, playing a popular tune. Phillips ran aft and that was the last I saw of him."

One outcome of the *Titanic* debate in the House of Commons was the compulsory extension of wireless telegraphy to the mercantile marine service. Wireless on ships above a certain tonnage had been compulsory for some time, but a continuous wireless watch was not, which naturally detracted from the value of the service; now, however, there was a thorough revision of all this, and a general tightening up of regulations.

In November, 1912, there might have been a serious loss of life when the *Otravia* struck a rock off the Falkland Isles in the South Atlantic, but her wireless calls for help were heard, and in consequence not only were all the passengers rescued, but the mails she was carrying were saved also.

With so many demonstrations of the advantages of wireless at sea, people were asking in how many other quarters it might not prove just as useful. There were allusions to the uses which might be made of it in times of war. According to Marconi, the public was beginning to realize that a cable cut cannot be repaired without a great deal of expense and possibly a serious loss of time, whereas a wireless message tapped is not a matter of material damage.

Again further wonders of wireless were attracting attention now in a new guise. Wireless telephony—in reality those "voices in the air" which had aroused the incredulity of

Marconi's father—was now a fact. At Monte Mario, in Italy, Professor Majorana had, in April, succeeded in sending a wireless telephonic message sixty-five miles, which after a few weeks of further experiment, he increased to one hundred and sixty miles. Even a change in a tone of voice could be noted, another step away from crude beginnings. It was a marvel then to hear voices by wireless, but Marconi had heard those voices in his dreams years before, and had known his dreams would come true.

One hot spring afternoon in Madrid, it was early May, 1913, the Spaniards who had risen from their siesta, and were wondering if it were cooler than it had been before midday, were interrupted from their reverie by a cavalcade of carriages and cars, which were hastening along the main street. The King of Spain could be seen driving with a man dressed in a naval uniform which was not Spanish—then someone called out, "It is Marconi, the man who makes the air talk." He had only just arrived in the Spanish capital, and was being driven to the Athenæum Club, where a gathering was being held, under the presidency of the King of Spain, in his honour. The Club reception rooms were packed with Government representatives and all kinds of people who were prominent in the world of Art or Letters. During the proceedings, the Ex-Premier Señor Moret made a presentation to Marconi, who delivered an address on wireless telegraphy.

A few days later, 22nd May, when he left Lisbon, en route for England, the Italian and Portugese Ambassadors in addition to many other distinguished people accompanied him to the station to bid him *au revoir*.

CHAPTER IX

"MARCONI SCANDALS"

FEW aspects in Marconi's character impress those who know him well more than his physical courage, and the fortitude with which he will endure great pain. This ability to suffer silently was never more severely put to the test than in September, 1912.

He had been paying one of those visits to the King and Queen of Italy, who were at San Rossore, near Pisa, which have always been of such frequent occurrence during his sojourns in his native land.

It was on 24th September that he had been discussing with the King some of the dangers of motoring on the then narrow Italian mountain roads, for Marconi, as a keen motorist, was much interested in the subject. Just before midday the Marchese Solari, who had been with Marconi, left for Genoa by train, whilst Marconi, who was travelling with a secretary, set off for the same destination by road. He drove fast as he had an appointment in the city later in the day. He was travelling towards San Remo and had reached the village of Borghetto di Vara, when he became involved in a serious accident. Borghetto di Vara is near Spezia, a quaint straggling village, with at that time only one main street. The road in the vicinity was notoriously bad, with a sharp bend which was the scene of a violent collision when the car Marconi was driving crashed into one driven by Commendatore Beltrani, who was travelling from Genoa, and had simultaneously collided with another car containing five women. Marconi was thrown on the stony road and received severe injuries to his head.

In spite of the pain he remained conscious. They were not very far from Spezia, and in a very short time, in response to a telephone call sent from a neighbouring village, the motor ambulance of the Royal Navy arrived on the spot. Among the other passengers in the cars five of the women were very slightly injured. Commendatore Beltrani sus-

tained an ugly wound in the head and crushed ribs, and his twelve-year-old son, who was in the car also at the time of the accident, was very badly cut about.

At the Military Hospital at Spezia Marconi was given an injection of morphia to ease the intense pain which he was suffering. Both naval and army surgeons were called to his side, as it was feared he had lost his sight; the optic nerve was severely injured.

About 2 p.m., Solari, who had arrived in Genoa, received a telegram, "Marconi has had a serious accident. He is at the hospital and his condition is grave."

Within two hours he was at Marconi's side, and when he asked him how he was, he received the reply, "I am suffering a good deal and I am afraid I have lost the sight of one eye. However, I am resigned to that as long as the other one is spared." By the evening Professor Baiardi, the Italian oculist, had arrived, and Professor Fuchs of Vienna, the finest oculist in Europe, had been sent for. After many consultations it was decided that the injured eye would have to be removed, to ensure the complete recovery of the other one. When this verdict was communicated to Marconi he was thankful to be assured that the sight of one eye would be unimpaired. Yet, it can be imagined with what horror an active man like Marconi must have regarded the possibility of blindness, even in one eye.

When the day arrived for the operation, he walked to the operating theatre with his usual firm step. The operation was successfully performed and when he recovered from the anæsthetic his only comment was, "Thank God that is over."

It was the wish of the doctors that he should keep as calm and quiet as possible for some days after the operation. These wishes Marconi obeyed implicitly, which greatly assisted his recovery. As he became more convalescent he was visited frequently by the Duke of Abruzzi, who brought him all the news he could to cheer him up. The King of Italy had been much grieved when he heard of the accident, and accompanied by Queen Elena, he visited Marconi at the hospital, both the King and Queen expressing a most earnest wish that he would soon be completely recovered.

At first the left eye was very weak, but gradually it grew stronger, and it was a very happy moment, when one sunny autumn day, he was able to remove the bandage and look seawards, where he could see the ships sailing on the blue waters once more. It was a moment he will never forget, for he realized what blindness would have meant to him.

By the late autumn he had recovered sufficiently to return to his experiments, and he set himself deliberately and methodically as always to adjust his life to the limitations of his disability. In this task he was completely successful. The loss of the eye made little outward difference to his work, as, indeed, it has made little difference to his appearance. In Venice, Doctor Rubbi made him an artificial eye which it is extremely difficult to detect.

Immediately after his recovery he paid another visit to America, and on his return to England he was met with a matter that has caused him great pain. He came to a London which was dark with the breath of scandal—scandal to which his name was essentially attached. Marconi shares were booming. People were making money out of the rising market. Following the ratification of a contract with the Post Office, it was hinted that manipulation had taken place whereby those with special information had, at any rate, not been losers. The affair was, perhaps, the most sensational of the new century, and it grew to such dimensions as to demand, and get, an official enquiry.

The brief facts are as follows. In March, 1910, the Marconi Wireless Telegraph Company submitted proposals to the Prime Minister for establishing communication by wireless telegraph throughout the British Empire. Governmental delays impeded the scheme throughout its unhappy course, but the project was welcomed at its inception. The word "scandal" was to be attached to the affair before the end; hard things were to be said, reputations assailed and dark motives alleged. Yet before the "Marconi Scandals" arrived at notoriety and the contract itself was cancelled the project was sound and simple enough.

Following Mr. G. C. Isaac's first proposals of an imperial wireless chain in March, negotiations through the year

finally resulted in a statement issued by Mr. Harcourt that the matter was under consideration by the Government and that it would be referred to the Imperial Conference in 1911.

In the discussions which took place with various authorities a certain amount of opposition was encountered. From the first it was suggested that the project should be taken out of the hands of private enterprise. In addition, the claims of rival systems were actively urged. In May, 1911, the Imperial Conference approved the proposal that an imperial wireless telegraph system should be erected; but it was not until July, 1912, that the Post Office entered into a contract with the Marconi Company for the construction of the stations.

Difficulties became apparent when the contract was submitted to the House of Commons for ratification. It was suggested that other systems were more efficient than the Marconi Company's system of telegraphy and the terms of the contract were adversely criticized. The result was that the contract was submitted to a select committee for report. In January, 1913, Mr. Herbert Samuel, the Postmaster-General, appointed a committee presided over by Lord Parker of Waddington, to report on the merits of other systems of wireless telegraphy. The committee's report, issued in April, stated that the Marconi system was thought to be the only system capable of fulfilling the requirements of the imperial chain. A revised contract with the Marconi Company was ratified by the House of Commons on 8th August, 1913.

Under the terms of this contract the company was to erect stations for the chain in England, Egypt, East Africa, South Africa, India, and Singapore. The stations were to be the property of the State, and the company was to be paid £60,000 for each station and in addition over a period of 28 years to receive a royalty of 10 per cent of the gross receipts of the stations.

Sites were selected and approved, and by summer, 1914, the Company's work of construction was well under way. The Post Office cancelled the contract at the end of the year —War had broken out in August—and the Marconi Com-

pany was awarded about £600,000 damages for the breach of contract.

When Marconi returned to London a select committee was sitting to consider the existing agreement between the Government and the Marconi Company for the construction of the chain of wireless stations round the Empire. Later it was said they would issue an *ad interim* report, postponing the ratification of the agreement and urging further enquiry as to the merits of several rival radio systems. On 22nd January, 1913, a London journalist appeared before the select committee in connection with his indictment of the Marconi Company. Marconi was called. He said how bitterly he resented the reflections cast upon the Company, especially as they had quite innocently entered into the contract with the Government.

The chairman of the committee explained that they only wished to know the cause underlying a suggested withdrawal of the company from the contract, and Marconi replied that as his company's work and honour had been so much attacked during the last three months he much preferred a full enquiry. Mr. John Redmond remarked that that was the view of many members of the committee, and Sir Alexander King explaining the attitude of the Postmaster-General to the Marconi Company and the latter's offer of withdrawal, said, "Marconi has been badly treated."

On 5th February, the Postmaster-General announced his decision not to release the Marconi Company from their contract. On 19th February, Mr. Muir, on behalf of Mr. Godfrey Isaacs, Managing Director of the company, applied at Bow Street for a summons for libel against Mr. Cecil Chesterton, editor of the *New Witness*. The summons was granted.

The case was awaited with great interest by all who wanted to hear more about the "Marconi Company Scandals" —as the affair had now unfairly come to be labelled, and in March the facts of the case were discussed in the House of Commons. Marconi again gave evidence before the select committee in May, and it became apparent that the Post Office was not in a good position with regard to the cancelled contract.

The report of the technical committee appointed turned out in favour of the Marconi Company, so that a great deal of sympathy was felt towards Marconi when he said in his evidence that he objected to the way in which his name was drawn into the affair and resented a statement that the Marconi Company had held wireless back fifteen years. This statement was amply refuted in the American Press by quotation from many American scientists, including Edison and Tesla. In May, proceedings were begun against Mr. Isaacs by two shareholders. They claimed a sum of nearly £1,000,000 in respect of 500,000 American Marconi shares which they alleged were the property of the English Marconi Company, and which were, they said, put on the market in 1912. Further, some talk of these "scandals" had travelled to the Continent, in one case the result of this was a threatened action by the Postmaster-General (Mr. Herbert Samuel) and the Attorney General, Sir Rufus Isaacs, against the Paris paper *Le Matin*.

The results of these charges and counter-charges is now history; it is sufficient for the purposes of this book to recall that Mr. Lloyd George and Mr. Isaacs were cleared of all charges of dishonesty.

On 22nd July, the new contract between the Postmaster-General and the Marconi Company was laid on the table at the House of Commons. It was generally held that if the Post Office had kept to its old agreement there would not have been any need for this new contract. It did indeed seem a waste of time to invite tenders for the installation of new shore stations when it was well known that only the Marconi Company were capable of carrying out the work. The Marconi Company in their new contract asked for an allowance to be made for the increased cost of materials since the date of their first agreement and compensation for the maintenance of a staff of engineers engaged specially for the work. And before the final agreement the Marconi contract was amended. Formerly, 10 per cent royalty was to be paid on the gross takings of each station. As long as Marconi-patented articles were continued in use during the next eighteen years, royalties were to be split up. There would be four separate royalties—one of 4 per cent on

internal transmitting apparatus; 2 per cent on internal receiving and 2 per cent each on external transmitters and receivers.

Marconi was glad when the settlement was arrived at, but he was bitterly angry at the manner in which he had been treated. When before the committee on the final occasion, he said, "I think you will understand that I very much resent all the caustic comments on my name such as: 'Marconi scandals' and 'Marconi manners' particularly on newspaper contents bills in the streets, all referring to things with which everyone will admit I had nothing at all to do."

Thus, stormily, it was that the chain of imperial wireless stations were projected. An echo of it all was heard nearly a year later, when three hundred shareholders attended the annual meeting of the Marconi Wireless Telegraphy Co. at the Hotel Cecil, at the end of July, 1914. The meeting was fraught with high feeling, yet there was only one man who raised complaint—and he was an unknown Irishman!

It must be admitted that there might have been more trouble had it not been for the staunch belief which everyone had in Marconi's integrity.

Marconi presided and made a long statement concerning the wireless industry, which he insisted was still very young. He defended the action of the company in not publishing particulars of the sale of shares to subsidary companies. It was absolutely untrue that they were buying and selling in the market. He refused to admit that some delay had been caused in the construction of the imperial stations because of suggested improvements. He regretted that there would not be time to deal with the cases brought in court by Mr. Locker Lampson and Mr. P. E. Wright. He was loudly cheered when he said, "I cannot refrain from telling you how bitterly I feel the association of my name with these political quarrels, with which you are all familiar, and to all of which I am luckily a stranger. If it were not for loyalty to the company, I would return to Italy, where I receive the enthusiastic co-operation of the authorities, whether scientific, civil, or military, quite independently of party or political issues."

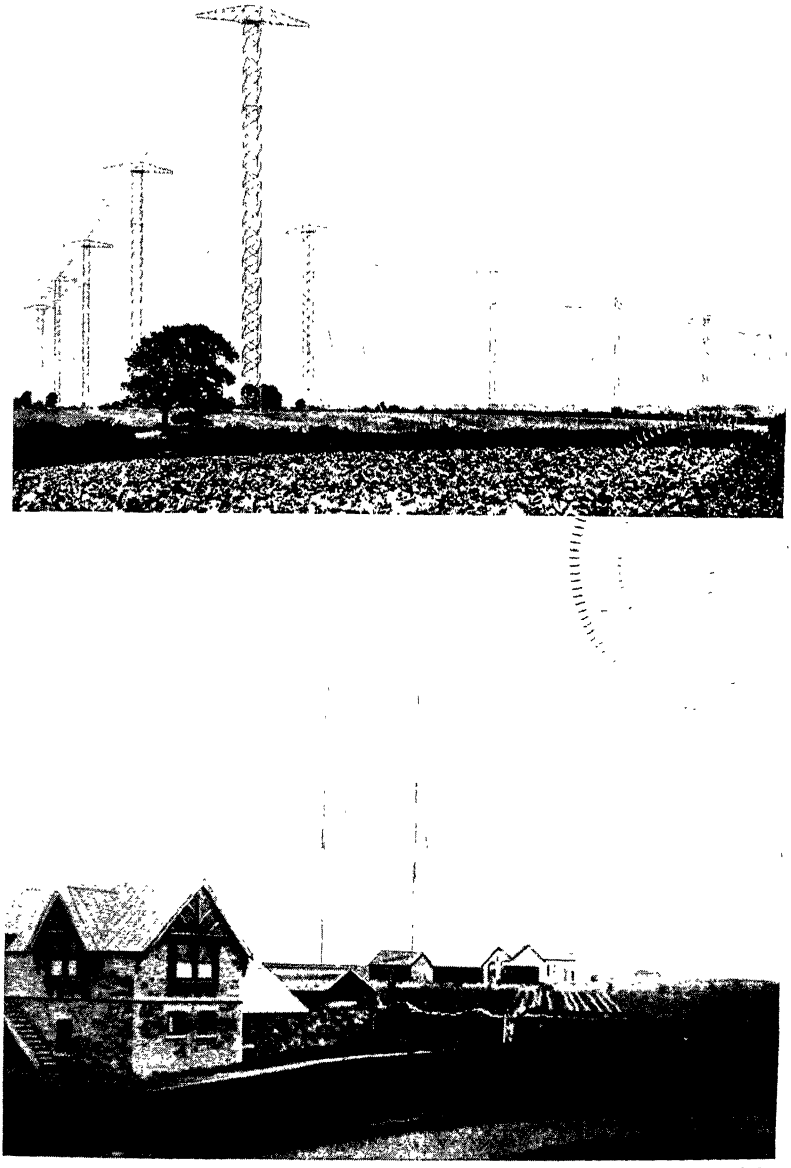
It was suggested at that meeting that Mr. Godfrey Isaacs seemed to attract litigation like a magnet and the managing director tendered his resignation. Though some of the shareholders worded their criticisms very strongly, Mr. Isaacs was re-elected unanimously, except for that lone Irishman. He voted against Mr. Isaacs and said that he would vote against everything. From the opening of the meeting to the close it was apparent that sympathy was with Marconi, and the meeting entered into his spirit of indignation regarding the manner in which his name had been used upon placards. . . .

Although Marconi himself felt keenly about the way in which his name had been used in connection with the so-called Marconi "scandals," there was no evidence lacking to show that the great majority of the public felt just the same about it. For example, on 25th July, 1914, there was a great gathering of people interested in wireless telegraphy, held at the Hotel Cecil, London. This occasion was used by Sir J. Henniker Heaton to compliment Marconi on the work his Company had done for world communication and to express his personal regret that Marconi's name should have been used as it was during the recent legal proceedings. The British Press of that date was also warm in its praise of "Commendatore G. Marconi, LL.D., D.Sc., Chairman of the Wireless Telegraph Company" as he was then generally spoken and written of.

The event which, however, definitely cleared Marconi of any suspicion was the honour conferred upon him by His Majesty King George.

Marconi was received at Buckingham Palace on 6th July, 1914, when the King conferred upon him the Honorary Grand Cross of the Royal Victorian Order.

In describing the experience, Marconi said: "I received a telegram calling me to Buckingham Palace. After my arrival there, the King talked with me for some twenty-five minutes about wireless telegraphy and all my latest discoveries. I was not at all surprised, of course, to find he was particularly interested in the Naval application of these inventions. I found, too, that His Majesty knew a great deal about wireless, and he spoke very kindly of my work. I



[*Marconi Wireless Telegraph Co., Ltd.*

MARCONI STATION AT POLDHU, CORNWALL, FROM WHICH FIRST TRANSATLANTIC SIGNALS WERE TRANSMITTED, CONTRASTED WITH (*top picture*) THE BRIDGWATER BEAM TRANSMITTING STATION

recall, too, that the King spoke to me about the prospects of war, and how true his prophecies were, viewed in the light of later events. He expressed his full confidence in victory for his people, but he was fully alive to the horrors which war would entail, and spoke sadly of the millions of young lives which would be the price of victory.

"I appreciated the honour all the more deeply," concluded Marconi, "because it was conferred at a time when the King was so extremely busy with political affairs. The honour he handed to me when I was leaving."

CHAPTER X

MARCONI AND THE WAR

BITTERLY as Marconi resented the political intrigue and scandal in England, he could find no fault with the attitude of his fellow-countrymen towards himself and his work. An audience of 3,000 people gathered on the evening of 8th March, 1914, at the Augusteo in Rome to hear him speak, and the reception he received moved him deeply in spite of his outward calm.

The tomb of Augustus makes a very fine circular concert hall, but it has its disadvantages. The exits and the heating arrangements, even to-day, are such that in 1935, during Sir Henry Wood's visit, the hydraulic gear for the organ-pipes was found to be frozen up and the concert had to be postponed. Another disadvantage was that although the acoustic qualities were good for a concert, a lecturer had difficulty in making himself heard in some parts of the Hall. Microphones have altered that now, of course.

This particular March evening, however, such was the pitch of popular enthusiasm that such dishes as "spaghetti à la Marconi," "ravioli Marconi," and "haricot verts sans fils," came into being and on to the restaurant menus overnight. The King and Queen of Italy arrived at the Augusteo shortly after 9 p.m. Marconi's appearance was greeted by enthusiastic cheers from the huge audience. A number of Ministers of State and Ambassadors were present, and later in the evening messages were received in the hall from Poldhu and also from Libya.

After the lecture Marconi left the hall secretly, avoiding as far as possible contact with that huge concourse of enthusiastic Romans. He had experienced the enthusiasm of the Roman crowd on more than one occasion and had no wish to repeat it. The most exciting adventure of this kind which befell him in the streets of Rome took place just after his first transatlantic test, when he was invested with the

freedom of Rome. He was walking through the streets when suddenly someone recognized him, and the shout went up, "Marconi—viva Marconi," and other complimentary expressions. A crowd gathered in a few moments, struggling to touch him and cheering loudly. In the press, Marconi lost his hat and stick, and his coat was torn down the back into two separate and unmanageable garments. Glancing to right and left, for some means of escape, he saw what he believed to be an empty carriage. Not until he had jumped precipitately inside did he find that it was already occupied by a startled young woman.

Marconi, breathless, had at first some difficulty in convincing the young lady that he was not a bandit, but he finally succeeded. The horse was travelling at full gallop, so that the explanation did not matter much anyway. When the driver at length managed to rein his bolting horse, Marconi got out of the carriage, but not until the next day, when she read of the incident in the newspaper, did the young lady know that she had come to the assistance of Marconi.

In July, 1914, the speed of wireless telegraphy had been increased to 300 words a minute and the experts announced that they expected to be able to telegraph from the new station at Carnarvon to New York at the end of the year. A few weeks earlier, the Marconi-Bellini-Tosti apparatus for direction-finding in foggy weather had been installed in the *Royal George* which sailed from Avonmouth, following excellent results experienced on board the steamer *Eskimo* sailing between Hull and Christiania (Oslo).

The dark clouds of war were fast gathering over Europe. Almost every day brought news of a disturbing nature—but they had not yet broken and business was being carried on as usual. At the end of July, for instance, two Marconi engineers arrived in Bombay (India) in order to supervise the erection of a large high-powered station in that city—but the time was drawing closer and closer when these activities would be suspended and all science would be diverted to the field of war.

In August, 1914, with the capture by Great Britain of Togoland, the largest wireless station in the world passed

into the hands of the Allies—and later proved a very valuable asset. This station had been originally established under the Telefunken system and was capable of communicating direct with a station on the outskirts of Berlin, three thousand miles overland.

The acquisition of this station did not excite the attention of the public very much at the time. For one reason there were matters nearer home which fully occupied their thoughts, and then no one had any idea of the various ways in which wireless might be applied and used in war time, it was an entirely new test, for what had been achieved during the South African War could not be reckoned as any guide at all. In 1914 wireless entered into quite a new sphere of activity.

Private wireless stations were now forbidden in England and Marconi had produced an invention, by means of which it was possible to discover the whereabouts of any station, thus eliminating the danger of hidden stations in alien hands.

In England a youth of nineteen was sentenced to fourteen days' imprisonment in the second division for having a wireless installation in his garden. He had been forbidden to use it a year earlier, but it was found that he had applied for the use of electrical current from a local power-station. With war-fever running high, and the fact that the young fellow lived with his German grandfather, it is surprising he did not receive a more severe sentence. His installation was dismantled.

In the last months of 1914 Marconi perfected a number of wireless inventions which ultimately proved most useful to the allied forces during the war, and it is satisfactory to recall that the British nation was not slow to appreciate the good work which the inventor was doing. The Albert Medal was presented to Marconi "for his services in the development and practical application of wireless telegraphy," at a meeting of the Royal Society of Arts on 13th April, 1915.

April also brought sad news to Marconi in the death of Major Flood Page, who had always been his ardent supporter and a champion of wireless telegraphy. At one time he had been general manager of Edison's Indian and Colonial Electrical Company, but he came to devote his attention

entirely to wireless. At the end of this month Marconi went to America to give evidence in a lawsuit brought by the Marconi Wireless Company of America against the Atlantic Communication Company of 47 West Street, New York, a subsidiary of the Telefunken. As Marconi was now a Senator of Italy he was continually questioned by the Americans upon the attitude of Italy to the war. Marconi assured them that Italy was in full sympathy with the Allies. As a matter of fact at this time Marconi was assured that Italy's entry into the Great War was inevitable. While the litigation was still continuing he had a conversation with the Italian Ambassador in Washington, who told him that he believed war would be declared by Italy in a few hours.

The following morning Marconi went to breakfast at his hotel; on his way down he had heard the newsboys calling: "Italy declares war"; a few moments later he read it in the morning paper.

He now realized that his lawsuit would have to be adjourned and this was later intimated to those concerned by his lawyers. It was an unusual and solemn moment in the State Court that day, when the news was conveyed to the judge, and Marconi was asked if the statement was correct.

"I am returning to Italy in order to serve my country," said the inventor quietly, his expression rather more serious than usual. Mr. Justice Veeder descended from the Bench and walking across the Court quietly shook hands with him. There was a hush throughout the vast chamber; all felt it was a solemn moment as the two men, both notable in their different spheres of life, clasped hands. "God speed you in your mission, Mr. Marconi," said the Judge quietly.

On 31st May, Marconi arrived in London and on 4th June passed through Paris. It was a strange and lucky coincidence for Marconi that Italy did not declare war quite as early as was expected, as in that case he would have been on board the ill-fated *Lusitania*, in which ship he had already made the westward journey.

Actually he returned to Europe in the *St. Paul*. His name did not appear on the passenger list, as it had been

reported, and with truth, that the Germans wished to capture him. There were no labels on his luggage, his most important papers were carried by a friend who was also on board, and on more than one occasion during the voyage he changed into very old clothes in order further to conceal his identity.

It is typical of Marconi that he did not enter his country's service with high rank. He was during the first fortnight of June, 1915, appointed a Lieutenant in the Engineers on the General Staff. His special duty was to be in charge of, and organize, the wireless telegraph service. Although he was nominally only a subaltern, the Italian Government placed him on the Naval Electrical Equipment Committee as well as the Army Engineering Staff.

Marconi's first experience of big gun firing at close quarters had taken place some years earlier, when he had served his country in Tripoli during the Turko-Italian War, but his experiences there sank into insignificance compared with the fighting which he soon began to witness in the Great War.

The first great battle which he saw was the great Italian artillery action at the Battle of Isonzo. Through field-glasses he saw the entire panorama of the battlefield from the high mountain slopes above. Of this battle Marconi said: "The experience of big shell firing, the quivering of the earth and the rending of the air by tremendous explosives, the sudden great upheavals of rock and earth were all most awe-inspiring. As the smoke and dust rolled away in great clouds among the mountains, there would be a momentary silence—then an awful crash, again crash upon crash, echoing and re-echoing throughout the surrounding valleys."

At Monte Grappe he was more closely associated with the actual fighting. The Austrian shelling was very heavy, and Marconi, like those around him, had to crouch and take cover in trenches. For a while he was in the thick of the fire, with heavy gun-fire booming and shells shrieking and whistling around him; a number of shells exploded within no very great distance from him, but he escaped quite unhurt from the experience.

He has to this day an historic memento of this battle;

a splinter of the outside of a shell, which he had made into a seal, and later used to stamp the treaty when he went as a plenipotentiary to the Austrian Peace Conference.

After these battles it was suggested to Marconi that he could invent a method of exploding the enemy shells by wireless. He stated that he could not see how this could be done.

Whilst these adventures were befalling the inventor, wireless was continuing to play its great part at sea. The liner *Wayfarer* of Liverpool was torpedoed in April, but saved by a wireless S.O.S. picked up at Queenstown. The White Star liner *Megantic* and several others had similar experiences. By May the only wireless station outside Europe owned by Germany was at Windhuk in German South-West Africa.

It is always a difficult matter to get universal approval for any scheme or improvement, and because wireless in warfare was an entirely new innovation, many controversies were bound to arise. One of the most important of these controversies dealt with a matter taking place at home. Mr. Godfrey Isaacs was severely criticized by a great many people because the Marconi Wireless Company published the German war news which they picked up, and this was only censored when it was known to be untrue. The critics thought that this "enemy" news might alarm the public in some instances, but later it was fully realized that this news was often quite valuable.

Wireless in warfare is, of course, most useful over large distances; for trench warfare such as was carried on in France and Belgium, communication by wire was just as effective, though commanding officers were not long in discovering the valuable use to which wireless could be put, as an alternative, to the older system. These were never better illustrated than during the Battle of Loos in September, 1915. Soon after the British troops captured the village of Loos, they installed a wireless set there which afterwards proved to be the only means of communication available at a most critical moment.

The French and British troops combined at the Battle of Loos in an action to pierce the German lines; when a gap

in these lines had been made by the British troops, the Cavalry Corps was to attack through the gap and be followed by the French cavalry, whereas if the French, lower down the line, were lucky enough to be first in breaking through the German lines, the English cavalry was to follow. It turned out that the early British attacks were so successful that it was thought perfectly safe to bring their cavalry into the breach. Actually the German line had not been really broken, although it appeared so, and it was a wireless report which prevented an action which would have been disastrous and cost the lives of hundreds of brave British and French cavalrymen.

Later the small wireless set in the village of Loos rendered further service, when the garrison who were contemplating abandoning the place, received news, by wireless, that support for them had been organized, and so they remained and the loss of the Loos position by the British was avoided.

This incident gave an impetus to the further use of wireless at the front, and it was not long before the Allies found how useful it could be during heavy artillery fire, when the older system was only possible if wires were extremely deeply entrenched. Wireless was not interrupted by fog, smoke, or heavy firing.

Marconi's actual war experiences were not entirely confined to Italy. He visited the Franco-British front at the end of 1915, and he was genuinely impressed by the tremendous determination and pluck of the men in the trenches, where, of course, the fighting was of an entirely different kind from that carried on by the Italian troops among the mountains. He said of this visit, on his return to London: "I hope to be forgiven for the remark, but these men realized their job better than many at home."

During this visit he met all the great Generals—Joffre, French, Foch, and Haig. There was a memorable luncheon which took place at Foch's headquarters, which was attended by Marconi and all the above generals. Conversation during the meal turned to some of the experiences which General Foch had had during the war between France and Germany in 1870. "How would you like to be a private

soldier again as you were then ?" Foch was asked. "Would it not seem very strange after having been a great general ?" Foch smiled at the question, then after a moment's thought said very earnestly :

"If I could start my career over again with my present experience, I would willingly become a private soldier again."

Marconi considers this remark typical of the man.

As one of the outcomes of this visit Marconi set to work upon various new experiments and improvements. It was, in fact, not long afterwards that it was announced he had produced a wireless telephony apparatus with which he believed he would eventually be able to transmit audible speech across the Atlantic. It had, early in 1916, a guaranteed range of thirty miles between ships at sea, which carried aerials 100 feet high on masts 200 feet apart. It was tried out first on Italian warships and our Admiralty was fully alive to the value of the invention.

At the annual meeting of the Marconi Company, which was held in July, 1916, the inventor wore the picturesque grey-blue uniform of the Italian Army, and it was noticed that he had two rows of medal ribbons on his tunic. To touch the lighter side of things for a moment, it is amusing to recall that the voluminous cloak which formed part of Marconi's uniform was adopted shortly afterwards as a popular feminine fashion.

During his address he explained many of the uses to which wireless was being put in the war, and explained that in 1915 £360,000 had been spent on wireless experiments.

Admiration was expressed at this meeting for some of the Marconi operators who had proved themselves heroes. Operator Swift, for example, remained on duty although his cabin had been blown to pieces by shell fire, and there were a number of other actions mentioned in which Marconi men had shown great bravery in appalling circumstances.

CHAPTER XI

MARCONI MAKES HIS HOME AT SEA

SOFT morning mists were melting away across the Thames one September morning in 1918, when workers hurrying to their offices noticed a strange flag floating in the breeze from the Victoria Tower above the Houses of Parliament. It was the Italian flag hoisted there because of the celebrations which had been planned to forge still stronger bonds between the Italian and British people.

A demonstration had been organized by the British Workers' League, to be held in Hyde Park on Sunday, 22nd September, to commemorate the entrance of the Italian troops into Rome in 1870 and the consummation of Italian unity.

The celebrations commenced with the arrival, on the preceding Saturday, at Folkestone, of the Royal Regiment of the Carabinieri, resplendent in their full-dress uniform, of black with scarlet facings worn with Napoleonic hats, and their swords flashing.

This regiment is world-famous; Italy's crack regiment. It was founded in 1814 by King Victor Emmanuel I, and achieved distinction in the Battle of Pastrengo, 1848, when it was the means of saving the King's life.

The regiment was met at Charing Cross Station on Sunday morning by both English and Italian officials, and representative bodies of the Workers' movements. Massed bands played almost all the way from the station to the Imperial Hotel, in Russell Square, and there was much shouting and cheering as they marched up Shaftesbury Avenue, New Oxford Street and Southampton Row. When Prince Colonna, the Mayor of Rome, arrived at Victoria, he was met at Victoria by the Lord Mayor and Sheriffs of London, whose guest he was to be. Immediately after his arrival at

the Mansion House he read a joint speech, composed by himself and Marconi:

"On arriving on English soil we are happy to convey brotherly greetings from our nation, and we are all the more glad because this friendly welcome confirms the bonds which unite our two countries. It indicates, too, how Great Britain appreciates the efforts of Italy at this historical moment, and the faith and will which animate us for the attainment of ideals common to both our countries. Through this conflict, which will ensure the world an era of safety and prosperity, wherein right and liberty shall be respected, the ancient ties of friendship and strength shall never be broken. United to you by similar ideals, we shall continue with you in the war, until victory, final and complete, is achieved."

Afterwards both Prince Colonna and Marconi were entertained at luncheon at the Mansion House and later at tea at the Baltic Exchange.

On Monday, 23rd September, the King received Marconi and the Prince at Buckingham Palace and conferred upon them both the Grand Cross and Order of the British Empire.

Then an interesting luncheon was given by Lord Northcliffe, which was attended by a number of ambassadors and ministers in London, and among other guests, Mr. Winston Churchill, Lord Beaverbrook, Lord Weir, Sir Albert Stanley, and Mr. J. R. Clynes. The principal toasts were "The King", "King Victor Emmanuel", and "Our Allies."

On 25th September there was a demonstration at the Albert Hall in Italy's honour, at which Sir Austen Chamberlain spoke warmly on behalf of the British Government, for Italy's Day. He remarked that some of the feats accomplished by the Italian Army had never been surpassed. Rome, I am told, he added, hopes to have a British Day. During those days, the Italian colours were to be seen everywhere in the London streets, and from the early hours of the morning women sold flags in aid of the Italian Red Cross Society. The fact that £25,000 was collected from Lloyd's members alone shows the generous response which was made in answer to the appeal.

All the way through the celebrations Marconi was

lionized; his arrival at the Alhambra one evening, when the Italian party were guests of Sir Oswald Stoll, was the signal for a wild outburst of cheering, and he received yet another enthusiastic reception when Gatti's restaurant entertained the band to dinner and Marconi and Prince Colonna were the guests of honour.

With the end of the Great War a new era of wireless opened which had its end in the development of radio telephony and broadcasting as we know it to-day.

The signing of the Armistice on 11th November, 1918, was a signal for many new activities to be commenced by the Marconi Company. War-time restrictions and regulations had held back many developments, though war conditions had also engendered ideas for many new uses for wireless. By December, 1918, with the permission of the Postmaster-General, there was a resumption of Press telegrams to and from Glace Bay, America, Clifden and so on.

Marconi had moved about a great deal during the war and had many homes. With a desire to be near the centre of things, yet quiet enough to get on with his work, he now took a villa on the Gianicolo, one of the hills which surround Rome. Here he began to experiment seriously with the transmission of the human voice. His visits to England were frequent and his interest centred upon the new station at Carnarvon, considered at that time to be the most up-to-date in the British Isles. From March, 1914, when it was first erected, until the introduction of the beam system it was constantly improved so that it should embody all that was newest and most efficient in wireless equipment. It was from this station on 6th January, 1919, that messages were despatched to Australia, where they were satisfactorily received for the first time by Mr. E. T. Fisk, Managing Director of the Amalgamated Wireless Company of Australia.

The Marconi Company, through its Chairman, Mr. Godfrey Isaacs, announced its willingness to establish *direct* communication with Australia whenever the Australians desired it. In March, 1919, Mr. Hughes cabled this offer to Australia.

It was suggested that the communication arrangements

would link Europe, America and Australia, thus encircling the world. The question, however, was considered to be one which required the most careful consideration as it was vital to the position of the Pacific cable. After further considering Marconi's offer the Australian Government decided, for the time being, to give no rights to any private undertaking or company.

Two years later, in October, 1921, a large private scheme was launched to establish a constant wireless service between England and Australia. In November, the Acting Commissioner for Australia in London was informed by the Commonwealth Government that an excellent wireless communication had been completed and was working well within the Australian Continent. By March, 1919, commercial communications by wireless had been resumed with the West Indies, thus placing matters much as they were before the war, though now, of course, with many improvements.

In addition to these new enterprises which were being put into practice, fresh experiments were continually being carried out, and various theories put forward. A new theory, for example, was suggested by Dr. Weagant, chief engineer of the American Marconi Company, who announced that "atmospherics (the ætheric waves produced by natural electric discharges), move at right angles to the waves that are thus set up when a wireless signal is operated, and always follow vertical direction." Many of the experiments carried out during the later days of wireless for the elimination of these disturbances have been based on his theory. Another discovery, of quite a different nature, and which interested Marconi a good deal, was made by the Indian scientist, Sir Jagadis Chandra Bose, who discovered that plants are sensitive to the long ether waves. By means of photographs he showed the faint quiver which a plant gave when subjected to these waves.

In October, 1919, the Marconi Wireless Telegraph Company arranged to sell to the General Electric Company, of New York, the whole of the shareholdings in the American Marconi Company on advantageous terms. The new radio corporation was to become the Radio Corporation of America.

An agreement was entered into by the Marconi Company with the General Electric Company and the Radio Corporation which provided, *inter alia*, that the English Marconi Company should secure the sole rights for the whole of the British Empire (and licences for other parts of the world, other, of course, than the United States of America) of all radio patents and inventions, this to include past, present, and future, until 1945. This arrangement included the Alexander High Frequency Alternator. The directors of the English Company recommended those who held shares in the American Company to send their proxies, duly executed, to Mr. Godfrey Isaacs as Director of the American Marconi Company.

Work on the Imperial Chain was being pushed forward at this time in continuing the construction of the Egyptian station and new English station near Oxford; and on 22nd November, Lord Milner, Secretary of State for the Colonies, as chairman of the Imperial Communications Committee, with the full approval of the Cabinet, appointed a committee to prepare a complete scheme of Imperial Wireless Communication. This scheme was to be prepared in the light of modern scientific progress and new Imperial needs and Sir Henry Norman was made chairman of the new body.

While wireless was forging ahead Marconi was making history as a peace delegate. In the early days of the war he had been entrusted with a delicate mission in America in the Italian cause. It was because of the good impression that he had made during the war that he was appointed a delegate to the Peace Conference in Paris. During his stay in the French capital he was invited to a conference with President Wilson, who at that time had a house in Paris. When this invitation became known it aroused a good deal of speculation—what questions would be discussed? What decision might be arrived at, through the parleys of these men, both so famous in their different ways, but sharing one quality—the ability to keep their own counsel. Flocks of journalists crowded round the hotel where Marconi was staying, and the number of different languages spoken by them must have rivalled the diverse tongues of the builders

of the Tower of Babel. They followed him to and fro to the President's house; sometimes, one more daring than the others, would tackle him personally, but always without any good result. Often he would just dismiss his questioners with a polite "I have nothing to report." Other times he would appear not to understand them, although he is a fluent linguist in practically all European tongues. Nor could one word be drawn from the President.

Marconi greatly admired President Wilson. "He had," Marconi said, "the spirit of a great reformer, and was indeed a great lover of peace. Above all he was a just man." To-day whenever Marconi visits America, he calls upon Mrs. Wilson, wife of the late President, for whom he had so great a regard.

The long and secret conversation which these two men had in Paris is no longer a secret. In Marconi's own words: "We discussed the question of Fiume and the Dalmatian coast fully." Afterwards Marconi sent a long telegram to Rome defending the Pact of London. In addition to Senator Marconi, the other Italian delegates to the Conference were Senator Tittoni, Minister of Foreign Affairs and Chief of the Delegation, Senator Scialoja, Senator Maggiorino Ferraris, and Signor Crespi, members of the Chamber of Deputies.

After the Peace Conference, Marconi felt that he had fulfilled his political duties for a time, and he had only one wish—to be alone with his experiments.

"I want to live at sea," he wrote in a letter to a close friend. "I shall sell my house in Rome and get in its place a yacht, which will in future be my home. There I shall be able to study and experiment without the fear of unwelcome interruption."

Then it was, that, with the approval of the Italian Minister of Marine Affairs, he bought a yacht and began a new romance in his career. The romance of a "snow-white miracle ship" as D'Annunzio, the Italian Poet Patriot so aptly describes Marconi's yacht. It is indeed a miracle ship, for not only has it carried the wonders of wireless into every ocean, but it was the first ship in the world to have the actual human voice transmitted to it, through space.

To-day the name of this yacht *Elettra* is inseparably connected, in the minds of many, with Marconi and his great work.

From the day he first sailed upon her, the *Elettra* became more than a home, a laboratory or a workshop: she became a retreat where he could escape the annoyances of an ordinary workaday world.

Few yachts can have had a more interesting history than the S.Y. *Elettra*, a handsome steam yacht of 700 tons. She was built at Leith in 1904, by Ramage and Ferguson, for the Archduchess Maria Theresa of Austria, and at this lady's special desire, it was christened *Rovenska*. Under this name the yacht was used for pleasure cruising in the Adriatic, and for many years was the envy of all the Italians who saw it. During the war she came into the possession of the British Admiralty, with a number of other enemy ships, and was used for naval purposes, chiefly mine sweeping in the North Sea. At the end of 1919, she was purchased by Marconi, and his first action upon re-registering her was to name her *Elettra*.

Her principal dimensions are as follows: overall length 220 feet (72.2 metres); length at water line, 198 feet (64.9 metres); beam, 27½ feet (9.2 metres); depth, 16½ feet (5.4 metres). Her consumption at normal cruising speed of ten knots is twelve tons a day, and on this basis enough fuel can be carried for twelve days' cruising.

The yacht has always been beautifully furnished, since Marconi owned it, and is equipped with everything conducive to modern comfort. To-day the private apartments of the inventor and his wife are amidships, where there is also a small cabin fitted out for his five-year-old daughter, who is named the same as the yacht—Elettra.

When at sea, Marconi spends hours alone in his laboratory. At other times he has a couple of assistants with him, this of course, entirely depends upon the experiment in hand at the time. It is impossible to describe this floating laboratory in detail, because, although the wireless cabin is the great centre of interest, its equipment is subject to constant change and improvement; it is to-day very different from what it was in 1920. Next year, it may have changed again. A



[*Marconi Wireless Telegraph Co., Ltd.*

AN *UN-WARLIKE* MOMENT AT THE ITALIAN FRONT. MARCONI (*centre*) DURING THE WAR

scientific laboratory must always be subject to continual change and modification.

However, let us take a brief survey of the wireless cabin, as it is to-day. First of all, there is what may be regarded as the standard wireless equipment, as apart from the more complicated experimental apparatus. This, as may be expected, has always been most complete, and is constantly being brought up to date.

It includes several transmitters and receivers, which are all designed to suit special purposes. Among these is a small spark transmitter of the "emergency" type such as forms the minimum wireless equipment required by international law, on the majority of sea-going ships. Then there is a powerful valve transmitter which is used for telegraph operation.

At present, Marconi has still on board the short-wave telephone transmitter, with a power of two kilowatts, with which he carried out a series of important experiments in the spring of 1930. These experiments demonstrated the possibilities of ships at sea making direct connection by wireless with the land line telephone networks of the world, so that passengers and marine officials can speak from their ships directly to their homes or offices ashore.

In addition to these transmitters, there are on board, various receivers covering a very complete range of wave-lengths, and a high speed printer for recording messages on tape.

A Marconi wireless direction-finder of the latest pattern is largely used for navigation by wireless.

The most recent experimental apparatus installed on the *Elettra* consists of micro-wave apparatus with which Marconi has been carrying out investigations into the properties and behaviour of electric waves of less than one-metre length, during the past three or four years. Particularly of note among this apparatus are the two micro-wave beacon receivers fitted, one on each side of the navigating bridge, which figured in the recent demonstration of marine navigation by micro waves which was given by Marconi to Government officials and shipping authorities from England as well as Italy.

In Marconi's own study and in the laboratory itself, there are a number of portraits of notable people. There is a large portrait of Il Duce, and Mussolini has written in his large bold handwriting: "To Marconi, Magician of Space and Conqueror of the Ether." The King of Italy has autographed his photograph; on the Queen's there is inscribed: "Yours affectionately, Elena." The King of Spain has written across his photograph: "To my friend Marconi." As might well be expected, the portrait of d'Annunzio has a most poetical inscription upon it: "To Marconi of the snow-white ship, who navigates in miracles and animates the silences."

A quick-firing gun, which is carried on the yacht, is the one which the poet gave to Marconi on his visit to Fiume. This gun is called "The most faithful one," and it was originally captured by d'Annunzio when he took Fiume for Italy. Marconi's entry into the harbour just after Fiume had been declared Italian was a memorable occasion. Crowds on the quays were dense and they cheered wildly as the *Elettra* sailed into the sun-swept harbour looking like a silver cloud. From thousands of hoarse throats came the cries: "*Viva l'Italia, viva d'Annunzio, viva Marconi.*"

In 1923, portraits of King George and Queen Mary were added to Marconi's collection of famous portraits; this was on the occasion of Their Majesties' visit to the inventor's yacht at Cowes.

Many of Marconi's friends have enjoyed a trip on the yacht when he has not been quite so much occupied with his experiments as is usually the case. The first time he took some friends for one of these trips was in 1920. These guests were the first people ever to dance on board any boat to music which was being played in London.

During this year Marconi conducted experiments in rebroadcasting from the *Elettra*. On one occasion he was in the Atlantic Ocean and his friend Solari was in Portugal, when they tried by arrangement to communicate with each other by means of radio. According to instructions which Marconi had given him, Solari went to the Marconi Company station at Monsanto, a few miles from Lisbon, to make the attempt. He was accompanied by some Portuguese officers

who were very sceptical about the matter. "Hello, Marconi," they heard him calling, "this is Solari speaking. Hello, *Elettra*." Solari's companions smiled and shrugged their shoulders. What an optimist he is, they said, but they soon changed their opinion when they heard a faint voice in reply. "Good evening, Solari, this is Lauro speaking. Here is the Senatore to speak to you."

In a moment the voice of the *Elettra's* Captain was replaced by that of the inventor. "Hello, Solari," he said. "Give my good wishes to the Portuguese officers who are with you. We are not three hundred miles from Lisbon. It is rather stormy and the yacht is tossing a bit, but if you listen, we are going to give you some music."

In a few moments gramophone records of Portuguese songs were delighting the ears of the Portuguese listeners, who could scarcely credit that the music was coming from so far away.

It is strange indeed that only fifteen years ago, voices transmitted through the ether should have seemed little short of magical—so it has been throughout Marconi's career, the progress of his invention has been so continuous and one wonder has followed another so closely that we have scarcely noted the date of their arrival.

Nearly a year after the Portuguese experiment, music from the *Elettra* caused great excitement at Cowes, where the *Elettra* was anchored in the roads during Cowes Week. In fact, on one occasion dance music played by the Savoy Orpheans in London was coming through so powerfully that representations were tactfully made by neighbouring yachts suggesting that the force of the music might be reduced —which of course it was. The strains of the band on that occasion, it was reported later, could be heard inland on the Isle of Wight.

It was a startling innovation in 1930 when Marconi spoke from the *Elettra*, then in the Mediterranean, to telephone subscribers in Sydney, London, Montreal, Bombay, Cape Town, New York, Buenos Aires and Rio de Janeiro; with this same apparatus Marconi took part in the opening of the Annual Electrical and Wireless Exhibition at Sydney on 26th March, 1930, by sending a wireless signal to operate

a relay which switched on the lights in Sydney City Hall and so opened the exhibition.

The *Elettra* played an important part in the experiments which led to the development of the Marconi short-wave Beam system as another means of long-distance wireless communication. By its great speed and efficiency this system has revolutionized world communication and has brought into commercial use the short wave-lengths of 15-100 metres which were previously considered too erratic in their behaviour for practical service. In the course of these researches the *Elettra* travelled many thousands of sea miles and has weathered many severe storms. In 1922, when Marconi was making his first Atlantic crossing in the yacht, he escaped a severe gale by making for Bermuda after the instruments on board had given the warning. But on the return journey they ran into a storm off the Azores which no amount of skill could enable them to escape. The yacht was severely buffeted about, but no damage done.

Marconi arrived in Southampton on 15th June, 1920. He had just visited Spain, Portugal, Italy and Algiers, in the course of a voyage to investigate the problems of the economy of energy in wireless telegraphy. New apparatus had given him some very interesting results concerning this research. The first question he was asked when the yacht drew into port was:

"Have you had any signals from Mars?"

To those who are ignorant but genuinely desire to acquire knowledge, Marconi is always patient, but he does not suffer fools gladly, and this question of communicating with other planets is one which he has been asked with recurring persistence for over thirty years. Always he gives the same reply: "I am concerned enough at present with business upon earth."

On 14th August, 1920, six years after the beginning of the war, the Defence of the Realm Act regulations in regard to wireless apparatus and transmission were finally removed, which made it much easier for experimenting. On 17th August, a Radio Research Board was appointed with four sub-committees to assist in the investigation of problems of all kinds which might arise in connection with wireless

in any form. The Admiralty, the Post Office, War Office, and Air Ministry were all represented on this Board and Admiral Jackson presided over it. It is impossible to define exactly where wireless as it was first known became wireless as we know it to-day, when we more or less include broadcasting under the same heading, but, loosely speaking, radio as we know it to-day had been born by 1920.

CHAPTER XII

BROADCAST ENTERTAINMENT BEGINS

TO most of us, radio is no longer a miracle, so quickly do men and women form a habit. Yet it is little more than fifteen years since the idea of voices and music emanating from a wireless set fired the imagination of everyone. It may be that in another fifteen years, television will have become as commonplace as radio to-day.

Among the various inventions which helped towards the transmission of speech, which we know to-day by the name of radio, few played a greater part than the thermionic valve invented by Dr. Ambrose Fleming. Almost an entire volume could be written about these valves and the improvements made upon them, also other forms of valves which were invented and which took years before even the most able scientists could appreciate their full value. In 1915, when some American wireless engineers built a transmitter they used no less than 300 thermionic valves, but they succeeded in transmitting speech, if very indistinct, from the United States to Paris. It was not until 1919 that Captain Round, of the Marconi Company, transmitted speech from Clifden to Canada, using only 2.5 kilowatts with a wavelength of 3,800 metres.

Conversation by wireless telephone took place across the Atlantic early in 1920 when, at St. John's, Newfoundland, Marconi Company representatives stated that they heard Chelmsford telephone station talking more than 2,000 miles away. They readily recognized the voice of the Chief, Captain Round, and identified most of his words, but they found it impossible to make out clear connected sentences. Interference prevented this from being possible.

Later two liners in the Atlantic reported that they had heard voices quite distinctly coming from St. John's station when they were between 500 and 550 miles away.

One of these liners was the *Victorian*, of the Canadian Pacific Company, and in view of later events her "log" makes interesting reading. Actually when the *Victorian* left Liverpool she set out to undertake a thorough test of the possibilities of wireless telephony. Records were kept throughout the journey and a newspaper called the *North Atlantic Times* was published both in the mornings and evenings.

The idea of installing a special wireless set on this ship had originated with Mr. Arthur Burrows (Uncle Arthur of early broadcasting days), and the Publicity Officer of the shipping company. The late Sir Thomas Fisher, who was then manager of the company, gave every possible support to the scheme and agreed that a special cabin should be built to accommodate the set which it was arranged would be installed by the Marconi Company's engineers—this was described by a temporary writer as a "three-kilowatt continuous wave apparatus." The log of the voyage was as follows:

July 21st. Telephone messages were put through at noon from the *Victorian* to the Marconi station at Chelmsford, the ship being 26 miles north-west of Tory Island, nearly 600 miles from Chelmsford.

The *Victorian* called up Poldhu the same morning and received a reply, but a few moments later Chelmsford interrupted to say the ship could be heard distinctly at that station also that Poldhu wished to be silent owing to the proximity of a ship in distress.

July 22nd. A concert from Chelmsford was clearly audible on the telephones when the ship was 900 miles away, but there were extraneous noises when heard on a loud speaker. These noises were thought to be due to bad electrical weather over the British Isles.

July 23rd. Press Association trials in new distribution by the Marconi station at Chelmsford were heard clearly, early in the morning. Nearer midday gramophone record concerts were transmitted to a number of ships, *Corsican*, *Olympic* and *Saturnia*; these ships and Canada all reported hearing the music clearly.

In the afternoon a surprise message was received by

telegraphy from the Marconi station at Signal Hill, Newfoundland; they, too, had heard the gramophone records.

Later still in the day Chelmsford gave a concert which was heard better than the one of the previous day.

July 25th. The log of the *Victorian* reported a new sea record for the previous day. The daily concert was heard clearly by all, although the ship was 1,530 nautical miles distant.

Newfoundland reported that the *Victorian's* gramophone concerts were heard at St. John's both on the previous day and the Friday before.

July 26th. From the early morning until the time when its paper went to press, the *Victorian* was in telephonic communication with St. John's, Newfoundland. There were constant interchanges of greetings between Ministers and Officials in Newfoundland and the Press representatives aboard the ship.

One interesting fact was gleaned during these conversations. The wireless speech had provided Newfoundland with an opportunity for telephony over a greater distance than was possible with the wired telephone installed on the island.

As the *Victorian* arrived at Sydney, Cape Breton, on July 27th, the entry of July 26th was the last one dealing with wireless experiments.

Another interesting development of 1920, which although a small matter in itself was important because of what it foreshadowed, was the despatch of the first business message ever sent between an office and an aeroplane. A Vickers-Vimy machine left Croydon at midday, and Mr. Instone, from the offices of Samuel Instone & Co., of Billiter Street, London, spoke to Mr. Chattaway, the pilot, on the prosaic subject of coal. Mr. Instone carried out the experiment in this way. He telephoned to the Air Ministry who connected him with the wireless station at Croydon, who in turn connected him with the aeroplane. In describing the incident afterwards, Mr. Instone said that while he was speaking he could distinctly hear all the noises of the aeroplane. It required one or two calls before the connection was established, and once there was an interruption because of the

Exchange. But this was soon put right and conversation resumed. "I have just passed over Folkestone," said the pilot in answer to a query as to his whereabouts. At the time this was considered a first class "news" story which thoroughly thrilled the imagination of the public. Col. L. F. Blaudy was responsible for the experimental work carried out by the Air Ministry.

In September, 1920, the Government Meteorological Station was removed from the Treasury Building to the Air Ministry in Kingsway (London), and wireless weather reports were broadcast to ships at sea, as had been done just before the war.

Marconi, as a keen sailor, is always interested to hear about the good which gale warnings, sent by wireless, have been able to do for fishermen and others at sea. "It is always good news to me, when I hear that lives have been saved at sea through wireless," he once said.

The idea of broadcasting music and entertainment to the public first originated in America, where advertisers were not slow to foresee a new and most advantageous field for themselves. To the public as a whole, the idea of dance bands and other music, coming directly to the home from fashionable hotels and restaurants, was most attractive. The first regular broadcasting station was built in the United States under the auspices of the Western Electric Manufacturing Company, at East Pittsburg. By the end of 1923, there were nearly six hundred broadcasting stations in America with somewhat chaotic results. In Great Britain, there were restrictions against anyone installing a broadcasting station, and it was only after a good deal of consideration that the British Post Office authorities granted the Marconi Company the right to carry out a limited amount of experimental broadcasting from a small research station at Writtle, near Chelmsford.

By November, 1920, however, there were fifty-seven wireless clubs for experimenting, and 1,700 people had permission from the Postmaster-General to erect wireless installations. This progress, although the fact has not been touched on previously, caused the greatest satisfaction to Marconi. He was at this time witnessing the rise of his

great invention from childhood to vigorous youth. Some of the early private experiments in radio must have been very crude and noisy affairs. Yet, as silence was the dread phenomenon to be feared, any noise was good noise. In a private letter of this date Marconi says: ". . . To receive anything is achievement to the amateur operator. Even crackles and bangs emanating from an amateur set is music beyond compare to the eager listener. I wish them all well. . . ."

On Monday, 13th December, 1920, there was a demonstration of wireless telephony carried out between London and Geneva, via Chelmsford, under the auspices of the Marconi Company. Messages were to be carried by land line from London to Chelmsford, and in a similar manner from Geneva to Bel Air, an excellently-equipped Swiss station. In the large hall of the League of Nations some hundreds waited intently for the first sound which would come from the gigantic loud speaker which had been set up. The messages came through eventually, but there was so much noise from induction that it was impossible to hear more than a few words at a time. In between each sentence, often unfortunately actually interrupting a word, were shrill shriekings from Helsingfors. Nevertheless, there was absolute silence from the listeners as a voice booming and fading, said: "Hello, Geneva!" and gave a short weather report.

Speeches followed from Lord Riddell, Lord Burnham, and Dr. Graham Bell, and finally the quiet, well modulated tones of Marconi were heard, and recognized at once. Amid the whistles and interruptions the gist of his speech could be followed, for it was brief, and he spoke slowly:

"I am pleased to take this opportunity of addressing the members of the Press present at Geneva on this occasion and by means of wireless." Hoping that his listeners were getting a fairly good reception he concluded, with best wishes for the success of the League of Nations.

Apart from his work, 1920 was a sad year for Marconi, for he lost that one friend who had always believed him and who had never for a moment doubted that success would crown his experiments—his mother. To-day Marconi has

only the most tender memories of those early days in London when, although he had no doubt about his own success, he had grave doubts about the length of time it might take him to convince other people that he had found a good thing.

It was with much regret that Marconi had to spend so much time away from his mother as the years passed on, and experiments, and business connected with wireless, claimed more and more of his time. His father, Giuseppe Marconi had died eighteen years earlier, in 1902, not so very long after his son's invention had so satisfactorily bridged the Atlantic. "Up to the very end," Marconi says, "my mother kept in close touch with my work, and her letters when I was in Canada or cruising, were a source of constant inspiration to me, as her gentle voice had been in my earlier days."

Early in 1921 Marconi returned from Italy, which was deep in the throes of the Fascist movement. Naturally everyone, especially the journalists, ever active where Marconi was concerned, were anxious to know what he thought about it all. Marconi had been an admirer of Mussolini all through the war years, and all that he would say on his arrival from the Mediterranean was: "Italy is settling down to work now. I do not think you will hear very much more trouble or disturbance."

His experiments at this time were largely in connection with direction-finding at sea. With this special intent, he cruised about for the next few weeks, returning to London again early in July, this time to test a new method of reception of wireless which had been invented by one of the Company's engineers. With this device it was possible to receive messages continually from the United States of America, without atmospheric disturbance or undue interference. The tests were carried out on the *Elettra*, which was for the greater part of the time anchored in Poole Harbour, though similar tests were carried out later in the Solent. Marconi told questioners that he had been working on this method for ten years before he arrived at the stage when he could carry out practical tests, which should give some idea of the patience and perseverance which the man possesses.

Another asset which has been most valuable to Marconi throughout his life, is his ability to utilize every opportunity which presents itself; he never turns down an idea or suggestion because it sounds simple or too far-fetched, as the case may be. He is, even to-day, the most sympathetic of mortals to the youngest and least experienced inventor who comes to him with an idea.

There was a story told in 1921 of a Roman schoolboy who got into trouble with his master because, quite contrary to rules, he had a wireless set of his own making at school—and worse sin still, had been wasting time working the set. Rumour said that Marconi had got in touch with the boy and granted him an interview. Rumour, however, exaggerated in this case—the true story, told by Marconi, is that the boy was the son of an ex-Minister of the Treasury and a director of the Banca d'Italia, and that it was this father, realizing his son's ability in wireless, who got in touch with a member of the Marconi Company, who found him employment with the Company when he was due to leave college. Marconi also adds that he believes he is still in the employ of the Company.

Marconi's heavy post-bag has already been referred to, and some of the many queer letters he received, but it is doubtful, if at any period of his life, he received more strange communications than he did in the early days of broadcasting.

There were people, obviously cranks, who thought the whole thing was wrong and "voices should not be allowed to fill the air." There were others who wanted to install stations, regardless of the strict rules and regulations prevailing in England. Other people wrote making all kinds of suggestions; then again there were those of a more prophetic turn of mind, who foresaw that some day there would be a demand for broadcast artists, and so they wrote to the inventor, demanding that he should start them on this new career.

The first attempts to use wireless telephony as a form of entertainment began when impromptu concerts were broadcast from the high-powered Marconi station at Chelmsford. One of the chief engineers—Captain Eckersley—was

responsible for them, and to the late Dame Nellie Melba goes the honour of being the first artist of fame to "broadcast"—an application of the verb that had not then been requisitioned.

The transmission took place on 15th June, 1920. A month later Lauritz Melchior broadcasted in one of the huge rooms at Chelmsford experimental station. The floor was of concrete and the walls were bare of any decoration other than that afforded by innumerable wires and what would appear to us now as very crude appliances. Mme. Melba was intensely interested in wireless, and took great personal pride at the idea of being the first singer to broadcast her voice all over the world. Eckersley himself (in shirt sleeves) was in charge of the broadcast, and it is doubtful if any of the successes which have since come to him have proved as thrilling as that first wireless entertainment. The crude microphone into which Melba sang had been made partly from an old cigar box, and there certainly was no provision for comfort.

Many thousands of listeners wrote enthusiastic letters afterwards about the broadcast, which was heard with surprising clarity on all kinds of wireless sets, even as far as Persia. Yet it is of major interest to note that there was at least one person who distinctly disapproved of the experiment. That was the Postmaster-General, who actually sent a protest, deploring that a national service such as wireless telegraphy should be put to such a frivolous purpose. Fortunately for the future of broadcasting the public was not troubled by cares for the dignity of high office. The public, however, deplored nothing, and the outcome was that scarcely two years later, at the beginning of 1922, the Post Office adopted a rather more sympathetic attitude and greater facilities were granted. The first wireless entertainment station was opened in London, and the famous 2LO, London Calling, began to make its uncertain voice heard in the land.

A station was installed at Marconi House and before many months had elapsed the number of licences taken out had increased from a few hundreds to more than thirty thousand.

History is written in that first tiny broadcasting station.

Two small rooms at the top of Marconi House in Aldwych were hung with mosquito netting of a greyish shade (it had once been white). A drapery of wires and an enormous quantity of apparatus and cumbersome machinery was the furnishing, and the staff of the station numbered six. Among them was a Scot, John Reith, destined it would seem, from the first to play a great part in the development of wireless broadcasting. Naturally there were other organizations as well as the Marconi Company, who were not only interested in broadcasting, but who were permitted to build stations. It is difficult to say what state of affairs these conflicting interests might have brought about, had not agreement been brought about to form the British Broadcasting Company. This was financed from various sources, but somewhat severe restrictions were imposed upon it by the Post Office. One of the first restrictions imposed, and one which has made British broadcasting different from that of many other countries, was the forbidding of all forms of advertising.

Rapid development soon called for a bold move from Marconi House to Savoy Hill, at the time looked upon as a most important step, but subsequent events showed that this was only the beginning of an enterprise, which is still destined to become larger and larger. It was on 14th November, 1923, that Marconi spoke for the first time from the London Broadcasting Station.

It was Mr. J. G. W. Reith who, prior to the inventor's speech, reminded those who were present, that only three years earlier, three men working in a couple of rooms had comprised the entire broadcasting staff.

Marconi admits to a thrill of pride regarding the progress of wireless, when he said: "I gladly accept the invitation of the B.B.C. to speak to listeners on the first anniversary of the official commencement of broadcasting in England. Twelve months ago, there were 7,000 amateurs in the country. To-day we know on the authority of the Postmaster-General, that there are half a million licence holders."

To-day, with more than 7,000,000 listeners in the country, it is interesting to recall some extracts from a broadcast talk which Marconi gave in 1931, concerning the birth

of that form of wireless which has come to be known as Broadcasting. In this talk he referred to broadcasting as the "lusty offspring of wireless telephony," and added that the practice of both these arts depends on principles common to wireless. The seed from which it can be said wireless sprung, was the discovery made by Michael Faraday one hundred years ago, that it was not necessary for two electrical circuits to be in actual physical contact in order that electric energy might pass across a small space between them.

This great discovery was followed by the masterly electro-magnetic theory of Clerk Maxwell, published in 1865, in which he clearly visualized the existence of electric waves in space, of which experimental proof was given by Heinrich Hertz in 1888.

"In 1895 I began my own researches with the express intention of utilizing electric waves for telegraphing across considerable distances.

"These first tests were soon followed by important improvements which made possible tuning and selectivity and by new discoveries such as that of the enormous distance over which these waves can travel and be detected notwithstanding the intervening curvature of the earth, which discovery enabled scientific investigators subsequently to learn something new in regard to the constitution and condition of our atmosphere at great heights, thus opening up vast and fertile fields of useful research which have lately allowed us to scrutinize still more effectively some of the mysteries wrapt up in the space which surrounds our earth.

"The beginnings of telephony as we know it, whether operated by line or radio waves, naturally date from the invention of the electro-magnetic receiver and the carbon microphone.

"This takes us back to the days before Hertz, actually to the time of Maxwell, for it was in 1861 that Philip Reis of Friderichsdorf, using a primitive form of electro-magnet and an imperfect electrical contact, obtained by means of instruments connected together by wires the first experimental results that deserve recording.

"Antonio Meucci in 1871 and Elisha Gray in 1874, among others, took out patents for apparatus which was certainly able to transmit speech, though not very perfectly —but it was reserved for Dr. Alexander Graham Bell, in 1876, to evoke the first practical form of telephone, and this was later modified for commercial use by employing a bar magnet, a speech coil at one end and an iron diaphragm, and was given the well known bell shape, associated with his name. For the carbon microphone, which was invented two years later, we are indebted to Professor Hughes, Thomas A. Edison and the Rev. Hunnings, as their discoveries in this field were all made public in the same year 1878.

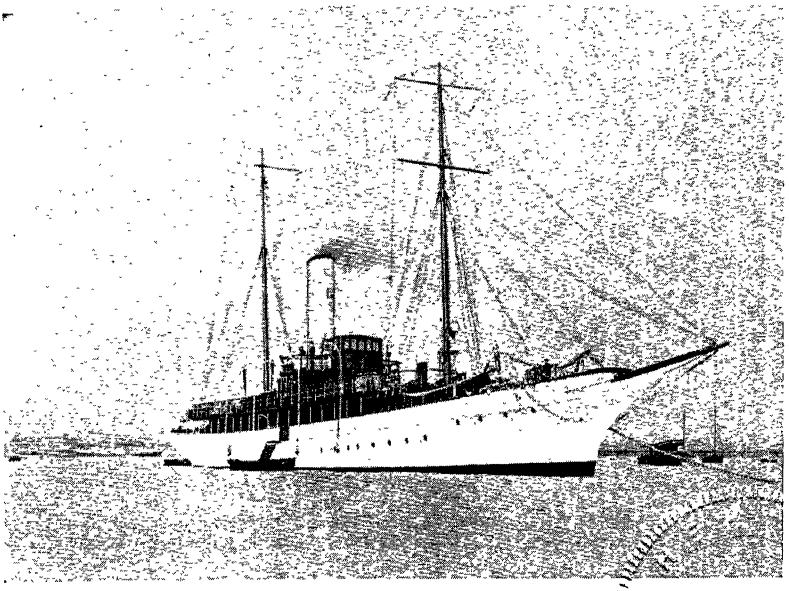
"From that time the telephone began its conquest of land communications, and later, speech was transmitted by submarine cable across narrow sea channels, and there for a time development stopped. This," explained Marconi, "was the position in 1900, when Professor R. A. Fessenden made the first attempt to transmit speech through space by electric waves and was able to effect some sort of a communication over a distance of one mile.

"As is well known, the speech currents are superimposed on some form of current or high-frequency waves which must be unbroken, not intermittent, and the spark transmission by induction coil and interrupter of that day, although quite satisfactory for telegraph working—I was then effecting radio communication over 36 miles—because of the dead intervals between the sparks, was quite unsuitable for telephony.

"To approach the required condition of carrier current Fessenden endeavoured to make the wave trains of the sparks overlap by increasing the number to 10,000 per second and he obtained some small measure of success.

"In 1902, a distance of 20 miles was covered by E. Ruhmer, and then in 1906, a real advance was achieved by Fessenden by employing for the first time the high-frequency alternator, which gave him a useful carrier wave of 2,000 cycles per second. This enabled him in the following year to transmit speech from Brant Rock, Jamaica, to Long Island (a distance of about 200 miles)."

It will be remembered what Marconi had been achieving





[*Marconi Wireless Telegraph Co., Ltd.*

S. Y. ELETTRA BOUGHT BY MARCONI AFTER THE WAR (*Lower picture*) FITTED WITH APPARATUS FOR LATEST SYSTEM OF HARBOUR DIRECTION FINDING BY SHORT WAVES

about this time with his messages across the Atlantic, and he reminded his listeners in this talk that after a number of ships were fitted with long distance wireless apparatus and a broadcast message service opened in 1904—this telegraphic service has continued without a break up to the present time.

However, to continue with Marconi's description of general progress in wireless telephony, he said:

"While I was much occupied with improving my trans-atlantic stations at Clifden and Glace Bay, Capt. H. J. Round, one of my assistants, had a small arc transmitter working near the Battery in New York, from which speech and phonograph records were transmitted to various places in New York, including *The Times* building and ships lying in the dock.

"There were, of course, no valve amplifiers in those days, and for best results the microphone was connected in the aerial circuit. In order to use power in the aerial, heavy current microphones were required. The best of these were the liquid microphones of Q. Majorana and G. Vanni.

"Employing arc transmitters Majorana was able to transmit in 1908, from Rome to Sicily, a distance of 300 miles, and Vanni in 1912 from Rome to Tripoli, a distance of 600 miles.

"The invention of the Fleming valve in 1904 and the three-electrode valve of Lee Forest in 1907 enabled the disabilities which had delayed the commercial development of wireless telephony to be removed, and the present state of the art realized.

"In June, 1913, Dr. Meissner employed the oscillating valve for the first time as carrier-wave generator for transmitting speech between Berlin and Nauern, a distance of 23 miles."

Marconi's first tests with a valve generator were made the following year, when he had apparatus installed on the Italian warship *Augusta* and speech was received from a second vessel.

Marconi then referred to the cessation of commercial wireless telephony on the outbreak of war and reminded

his hearers that not until after 1918 was it possible for all European countries to resume their tests. "In March, 1919," he explained, "with the object of demonstrating that transatlantic telephony could be achieved using comparatively small power, one such communication was established and satisfactorily maintained for ten days with Louisburg, Canada, by transmissions from my station at Ballybunion, Ireland, using a valve transmitter with only 2.5 kilowatts output from the generator, a wave-length of 3,800 metres, and an aerial 500 feet in height.

"In the same year my assistant, Mr. C. S. Franklin, carried out a short-wave telephony Beam test on 15 metres, across the Irish Sea, a distance of 80 miles, and work on this wave-length was continued in 1921, when two-way telephone communication was established between Hendon and Birmingham, a distance of 97 miles, using reflectors.

"Then, in 1920-21, followed a successful test of duplex telephony on 100 metres, between Chelmsford and Southend; experimental stations were erected by my engineers at Southwold and Zandvoort, Holland, which worked duplex across the North Sea with one kilowatt to the aerial on 100 metres."

Having thus described what he called the birth of broadcasting, Marconi continued with a description of what had been done from Chelmsford and how the first Broadcast Studio in London had been installed at Marconi House.

However, deeply as Marconi was interested in broadcasting, and the great industry which he foresaw would come about as the result of it—this form of wireless was not his chief interest, for at this time he was concentrating particularly on researches for his "Beam" system, which later brought about almost as great a revolution in the world of wireless as that first signal across the Atlantic had done less than a quarter of a century earlier.

Before, however, Marconi's new researches are described, it would be of great interest to make a brief survey of the surroundings in which most of his great achievements had been carried out.

In the business world we often judge men by their offices, and suppose that a man who employs every labour-saving device, and has everything planned so that the maximum of

work may be accomplished in a minimum of time, is bound to be able in his work.

Obviously, the laboratory of a scientist can never be planned in the same way as an office, but it may, nevertheless, give the same amount of insight into its owner's character.

Marconi's first laboratory, it will be remembered, was at the Villa Griffone, and it is remarkably interesting to note that in describing this laboratory and the experiments he carried out there, he has said, on more than one occasion: "I used short waves and reflectors, and although those reflectors were not of the type we use to-day, it is interesting to record that the present "Beam" system springs from those early experiments."

This latter remark was of more than usual interest in 1924, as subsequent events will show.

His first seaside laboratory in England was at Lavernock, on the Bristol Channel. The first "floating" laboratory was on the *San Martino*, an Italian cruiser, placed at the inventor's disposal for experiments in July, 1897.

The description which the inventor gives of the wireless telegraph station, established at the Needles Hotel, Isle of Wight, is amusing, in the light of modern achievement, as well as interesting, and shows Marconi's remarkable ability to make use of the only material available.

"In this hotel," he says, "the wireless room was a private sitting-room on the ground floor. There was a carpet on the floor, and a large bay window, leading on to a lawn, where many kinds of birds used to come and eat up the crumbs we threw out for them. A hole was drilled in the window pane and the aerial led through to the mast outside."

The insulation of this aerial presented a certain amount of difficulty in wet weather, and when the air was thick with salt sea mists. On such occasion, at Marconi's suggestion, he and his assistants used to wash the window over with paraffin oil to improve the insulation, whilst the lead-in wire was covered with various insulating substances, and at that time the best of these was found to be rubber tape applied with a rubber solution.

In describing some of the apparatus, Marconi says:

"As far as I can recall now, I had one 19-inch spark coil and later an 18-inch one. I experimented with various types of signalling keys used in the primary circuit of the coil, and with various contacts on these keys, carbon, silver, etc.

"The battery for driving the coils was a large one of dry cells. At the commencement of experiments in this laboratory, there were no indicating instruments, although later there was an ammeter in the primary circuit of the coil and accumulators for driving the coil. A wooden mast was used, the height being about 130 ft.

"All kinds of aerials were used at this station, some made of single wire, and others of many wires in parallel. Then aerials made from rabbit wire-netting were used, first in the form of a strip—then sausage form. It was, however, working with a plain aerial that the best communications were set up.

"The laboratory at Madeira House played an important part in early developments. Here there was a wireless room a little more than eight feet square, situated in the basement, and with only one small window. A slightly larger room next to this was used as a workshop.

"Here, as at the Needles Hotel, a hole was drilled in the window pane of the smaller room, through which the aerial was taken to a ten-inch spark coil; this latter stood on a small table, just in front of the window. Other furniture (for want of a better description) was some shelving screwed to the wall, on which was a miscellaneous collection of spark balls, sensitive tube receivers (coherers), wire, etc.

"There was a battery of dry cells to work the spark coil under the table whilst a sensitive tube receiver stood upon it, as well as a key for operating the coil and a Morse inker for recording the receiving signals. The aerial was direct, coupled to the coil, whilst the wave-length was taken as being four times the length of this wire. The aerial was insulated by rubber tape at the point where it went through the hole in the window, and the earth connection was made of a plate buried in the earth just outside the window. The workshop was effective but primitive, an old carpenter's bench stood in the middle of the room, and there was a small metal working vice screwed on one end of it. A good

mercury pump was used for exhausting the sensitive tube detectors and a hydrogen apparatus for making the gas, which was used for the glass blowing, when detectors were manufactured."

When Marconi talks of these old laboratories, he admits that he sometimes wonders how he and his assistants managed with the material which was then available.

"At that time," he said, "we had to make almost all our apparatus entirely by hand, winding coils from wire, when the actual wire itself was unobtainable in the form in which we required it, so that we had to strand it ourselves before we could make the coils. Then there were no moulded insulators on which to wind the coils; glass, paper, and paraffin wax were then the three insulators which I usually employed."

The laboratory at the Haven Hotel, Poole Harbour, was larger and more comfortable than any the inventor had had up to that time. This room was about eighteen feet square, and was only semi-basement, another improvement —it had two windows. Actually according to Marconi's description, this was just an ordinary hotel sitting-room, but it must have soon looked very unlike one, with a line of small tables set along the wall under the windows. Some of these tables were used for carrying the receiver and transmitter as well as for experimental work and one was just a work bench.

"Imagine how we managed without outside help in those days," says Marconi, describing a method of drilling a hole in a window-pane. "One of my assistants carried this operation out with a bradawl and the point of an old file, which he had dead hardened in the sitting-room fire."

Compare the tools manufactured in connection with wireless to-day and this description given by Marconi.

"The tools used for making our early apparatus were simple in character and few in number. In fact they were similar to those which any village carpenter would have used. A small metal-worker's vice, a home-made hand-winding arrangement for making coils, and a paraffin-wax melting pot for making the principal kind of insulating varnish. Convenient insulating varnishes such as can be

obtained at any oil shop to-day were unobtainable and our early efforts with shellac were not encouraging. This was probably due to the presence of water in the methylated spirit which was used as a solvent for the shellac. Once I remember a good varnish was made from resin and methylated spirits, but usually we returned to the paraffin pot as a quick and ready means of securing good insulation."

It was at the Haven Hotel that the first receiving jiggers or oscillation transformers were made. These were coils of wire often wound on paper tube-formers.

As jigger reception was followed by jigger transmission, so jiggers became larger and required larger formers to wind them on. Glass bottles were found to answer this purpose excellently, and formed splendid cores for these early coils.

After jigger reception and transmission came tuned circuits, and the condensers for tuning these circuits gave some scope for thought and practical development. Various types of sliding plate condensers were made and then the forerunner of the modern "Bioli" condenser. This in its earliest form was a paper tube, built up of thin paper and paraffin wax, with a copper foil coating outside that, whilst inside the first tube, another was made to slide, and to carry with it a second cylinder of copper foil.

These early researches on tuned and coupled circuit extended over a considerable time, and enabled Marconi to greatly extend the range of working wireless.

It would not be correct to describe all the places in which Marconi worked in his early days as laboratories; they were often far from that mark, but wherever he installed his apparatus, temporarily or otherwise, he always showed his amazing ability of utilizing the smallest thing which might be of help to him. On the famous occasion of the Kingstown Regatta of 1898, fully described earlier in this book, he set up his receiver in the Harbour-master's garden at Kingstown. Later at Poldhu, all kinds of new apparatus were tried out, though this Cornish station cannot be described as a laboratory; instead, it has the honour of being the first transatlantic wireless station.

In this résumé of the early laboratories, it would be

impossible to even enumerate all the stations where he has carried out experiments at some time or another, for that is another characteristic of Marconi, and one in which he differs from many other inventors—he can get to work in strange surroundings; if there is an experiment to be carried out, he sees it through perfectly oblivious of his whereabouts.

CHAPTER XIII

"BEAM WIRELESS" ARRIVES

NINETEEN TWENTY-FOUR will be remembered as a landmark in wireless history, because during that year, there was introduced to the public an entirely new method of utilizing it.

Of the "Beam" system, Marconi has said: "I think that it is regrettable that—despite the intense amount of radio research, carried out in all countries, during the last twenty-five years, it has been left to us only recently to discover that these waves possess more valuable and unsuspected qualities in regard to world-wide transmission and they are capable of results unobtainable by the lower frequency system which, up to almost the present day, has held the field for all long-distance communications."

It is of passing interest to note that Marconi demonstrated to Sir William Preece in 1896 that short waves could be directed in a beam, and in those days he used a parabolic reflector. At this time this field of research did not promise to be a very happy one. Nothing then had been found out about the Heavi-side layer in the upper atmosphere. It was known that the attenuation of these short waves was high, and that in their propagation only a small amount of power could be used. The reflection of these waves was not suspected and further experiment ceased. Marconi never entirely abandoned the idea of commercial short-wave communication from his mind.

It was in 1916 that Marconi decided to carry out further experiments with these waves for war-time purposes, and on this occasion he used a coupled spark transmitter and a crystal receiver. He used reflectors made of a number of wires, tuned to the actual wave used, and arranged on a cylindrical parabolic curve with the aerial in the focal line.

To continue in the inventor's own words: "My first experiments in the systematic study of short waves in

combination with arrangements for directing them in a given direction were carried out in the latter end of 1915. Other early experiments were carried out in 1916 at Genoa, then at Livorno, where I found that good directional working could always be obtained with properly constructed reflectors and with the apparatus then obtainable. First experiments along these lines, were for a distance of about three miles, then six miles."

Further experiments were carried out by C. S. Franklin, when in 1917, with a wave-length of three metres, he sent messages from Carnarvon over a range of twenty miles, though it was not until two years later that Franklin contrived to use thermionic valves for the generation of ultra short waves.

Still further tests were made, and on a wave-length of fifteen metres a talk was strongly heard at Kingston Harbour, seventy-eight miles from Carnarvon. After that, experimental stations were set up at Hendon and outside Birmingham, and messages were exchanged between these also.

Marconi says: "I knew, as did every other experimenter along the same lines, that short waves, or at any rate, waves of the length I was using, had much shorter ranges during day-time than at night. This fact I had first observed in February, 1902. By perfecting various devices I found during my experiments in the *Elettra*, in 1923, that day ranges could be still made reliable and of world-wide magnitude, even if the wave-lengths were still further reduced.

"After Mr. Franklin, under my direction, had followed up this subject with great thoroughness, we were quite convinced that short electric waves possessed qualities, which up to that time had remained unknown, and that this new line of investigation was opening up a vast field of profitable research full of undreamed-of possibilities."

All during the spring of 1923, experiments were carried out by Marconi and C. S. Franklin between a small experimental transmitting station, specially installed at Poldhu, and another installation on the *Elettra*, and the principal objectives of these experiments were:

1. To ascertain the day and night ranges and reliability of signals transmitted on wave-lengths of less than 100 metres,

possibly over considerable distances, with or without the use of reflectors or directional devices.

2. To investigate the conditions which might adversely affect the propagation of the short waves, such as interposition of land or mountains between two stations, and also how the day and night ranges varied with the wave-length employed and the power utilized.

3. To investigate and determine, if possible, the angle and spread of the beam of radiation emitted when employing a transmitting reflector, especially with a view to the possibility of establishing long distance, directional service.

Some very interesting experiments were carried out by Marconi, who, accompanied by Mr. Franklin, made a Mediterranean trip on the *Elettra*, during which ports in Spain, Morocco, Madeira and Cape Verde were touched. It was ascertained that with a wave-length of approximately 97 metres and a power of 12 kilowatts in the aerial, signals could be reliably received during daylight up to a distance of 1,250 nautical miles.

It was in carrying out these tests that Marconi found it was by no means correct, in dealing with waves of about 100 metres, to refer to distances covered during daylight as "day ranges," because the strength of the signals, which could be received, varied definitely and regularly in accordance with the mean altitude of the sun over the space or region intervening between the transmitting and receiving stations.

The night signals came in always with great strength and remarkable regularity up to the maximum distance to which the yacht was able to proceed on one occasion, which was as far as the Cape Verde Islands, situated 2,320 nautical miles from Poldhu.

Marconi, in describing these experiences, says:

"The strength of the signals we received then, at night, left no doubt in my mind that their practical range was very greatly in excess of that distance."

According to Marconi the general impression which prevailed among most technical experts at that time, with regard to the behaviour of short waves was: that their range during day-time would be short.

Their night ranges, although occasionally considerable,

would be extremely variable and freaky and subject to long periods of "fading," which would render them altogether unreliable for practical purposes of long-distance commercial working. Also that any considerable stretches of intervening land, especially if mountainous, would greatly reduce the distance over which it was possible to communicate.

As often happens in such instances, the experts were proved to be wrong, for the experiments carried out by Marconi and Franklin in 1923 proved that day-light ranges were not by any means inconsiderable, but much greater than had hitherto been believed possible; that night working was much more reliable than anticipated and fading was not very serious. A fact of great practical value which was also observed was that even in tropical countries the atmospheric disturbances which are termed "static" or "X's" were invariably less troublesome and severe when receiving on short waves than those experienced with much longer waves which, up to that time, were being exclusively used for long-distance work.

Again further tests were carried out during February and March of 1924, with the object of determining the maximum practical ranges of these waves. As a result of this, Marconi found that while the day range of a 92-metre wave was about 1,400 miles, that is, greater than the day range of a 97-metre wave, strong and fairly reliable signals could be received during the dark hours not only in the United States but also in Australia, which really meant world-wide distances.

It was after these encouraging results that Marconi was, as he describes it, "Tempted to try a telephony test to Australia on 30th May, 1924. This feat, which was carried out with a 92-metre wave-length, and no reflector, was a complete success. This was the first direct conversation ever to take place with Australia.

In June, 1924, the first beam wireless experiments were carried out between South America and Poldhu. The first wireless beam message to Buenos Aires was sent from London by Saor Le Breton, Minister of Agriculture to the Argentine Republic, who was at the moment on a visit to England. It was received in Buenos Aires by General Justo, Minister of War, and the news of the experiment

aroused a great deal of enthusiasm among the inhabitants of the city, many of whom remembered Marconi's visit there, and the success which had been his on that historic occasion.

Numerous other tests were carried out in far-distant countries, including Japan, this from a small power-station at Chelmsford, which utilized only about *one fifth* of a kilowatt of antenna energy, the object of this being to test still shorter waves. It was thus noticed that a wave-length of 10 metres was about the shortest which enabled signals to be detected at Sydney, Australia, and then only during the time when practically the whole of the great circle track between England and Australia was exposed to day-light.

When the Marconi Company suggested to the British Government in 1924 that they were ready to establish communication to any parts of the Empire, by short waves, under the "Beam" system, the suggestion was considered sensational.

It was because of the tests carried out between the *Elettra* and Poldhu that the Marconi Company felt confident to approach the Post Office with a desire to enter into the contract.

Later, in the autumn of 1924, still further tests were carried out by this system with Montreal, New York, South America and Sydney. It was found that messages could be received from South America at the Poldhu station when less than 12 kilowatts were used. Australian tests which were made about the same time proved that messages could be exchanged between Europe and the Antipodes for twenty-three hours out of the twenty-four. As on former occasions, the *Elettra* proved invaluable in these beam experiments. Marconi, when talking of his yacht, often dwells on the advantages which a moving station has over a stationary one in the matter of experiments.

The Marconi Company, in conjunction with the Post Office, soon decided upon sites for the new beam stations. A station was erected at Grimsby with a receiving station at Skegness, while a site at Dorchester was selected for transmission to both North and South America, with a receiving site at Somerton. A number of improvements had still to be made in the system, and before many months Franklin

was responsible for the invention of a special power valve. Transmitters were designed with as much flexibility as possible so that adjustments could be made if the wave-lengths chosen for each station had to be altered. Again there was another problem to be faced—the discovery of the best method of reception. The design of a commercial receiver was entrusted by Marconi to Mr. Mathieu, who had been assisting Marconi with short-wave tests, made on his yacht for some time. After many experiments and tests Mathieu produced a receiver which was thoroughly sound and fully satisfied those who had charge of the commercial services.

In many foreign countries the Marconi Company's competitors had watched these developments in the short-wave system with scepticism. The immediate success of the beam system came as a great shock to them. As might be expected, the opening of the beam service soon had a serious effect upon the receipts of the cable companies, especially where there had been no wireless competition hitherto. The Government, realizing the importance of the cable system from its strategic value as well as its reliability, called together the heads of the wireless and cable companies and finally a merger of interests was effected and the Imperial beam service reverted to a private concern. Eventually the imperial and foreign communications were controlled from one centre. In this way it was found that many useful economies could be effected and new wireless channels opened up.

Among the developments which have taken place in beam wireless during the last few years has been the ability to transmit on two or more services from the same aerial, this with a small wave-length difference but without mutual interference. In point of fact, even telephony from one transmitter, and telegraphy from the other have been carried out with the same aerial without any difficulty. In the earlier days of beam wireless receiving and transmitting stations were erected on separate sites. When it was found that transmitting and receiving aerials could be erected on the same site and that receiving and transmitting plants could be erected in the same building the experts immediately adopted the economy of the idea.

It is no exaggeration to state that, wonderful as were Marconi's early discoveries, his research into beam transmission has been beyond value to the civilized world.

The success of the beam stations working at present—such as that at Rugby—are due entirely to Marconi's intuition and perseverance and Franklin's technical skill and foresight. The beam service was a notable step in radio development.

It is of interest to record what Marconi said of this work on the occasion of a presentation to Sir Oliver Lodge at the Central Hall, Westminster, on behalf of popular wireless, on 23rd October, 1925. "Sir Oliver Lodge is, as we all know," said Marconi, "one of our greatest physicists and thinkers. In the very early days, after the experimental confirmation of the correctness of Clerk Maxwell's theory as to the existence of electric waves and their propagation through space, it was given to only very few persons to possess a clear insight in regard to what was considered to be one of the most important hidden mysteries of nature. Sir Oliver Lodge possessed this insight in a far greater degree than, perhaps, any of his contemporaries.

"We look back over a comparatively short period of time, and proudly reckon up all the benefits which wireless has conferred on mankind—telegraphy, telephony, broadcasting, safety at sea, air navigation. These are all but steps in the ever-ascending ladder of wireless applications. But although our knowledge has progressed, and although we now know a great deal about producing, radiating, and receiving these waves, we know little, and, I might say, we now realize that we know a good deal less than we thought we knew some time ago, in regard to laws governing the propagation of electric waves through space across big distances. Little over two years ago we believed that to cover world-wide distances it was necessary to employ large amounts of power and long waves. We thought that short waves could only be utilized for communication over considerable distances at night, but that these night ranges were freaky and altogether too unreliable to allow the carrying out of commercial work.

"Now all this is changed. We found that these waves will carry messages at all times of the day and night to such

distant parts as Australia, and I might recall the successful tests by amateurs in exchanging two-way communication with New Zealand.

"In regard to New Zealand and Australia, we have never so far been certain as to which way the waves travelled round the earth, there being always when working to the Antipodes, a practically dark way round one side of the earth, while the other was exposed to day-light."

"During the last few days, some additional tests have been carried out between Chelmsford and Buenos Aires by Captain Round and other engineers of the Research Department of the Marconi Co. over 6,000 miles. In regard to the Argentine, the great circle track of transmission not being very far from a north-south direction, there is no other track of comparatively the same order of distance over which the waves could travel in darkness at the same time as when the short direct track is exposed to day-light, with only an amount of energy, comparable to that used in amateur tests, we have been able to communicate with the Argentine at a speed of thirty words a minute during the hours of day-light."

The Beam agreement with the British Government, dated 28th July, 1924, marked the final success in this country of Marconi's beam experiments. This contract was the subject of a debate in the House of Commons at the time, and a speech by Mr. Ramsay Macdonald, though to-day it is doubtful if many people remember the terms of an agreement which has actually done more than any other contract to revolutionize communications between people of all classes and all nations.

The contract stipulated that the transmitting stations should dispose of a power of 20 kilowatts to be delivered to the anodes of the tubes used for generating the oscillations, that the aerial reflector system was to be designed so as to concentrate the emitted waves within an angle of fifteen degrees on either side of the axis of the transmission, the energy emitted beyond this angle not to exceed five per cent of that on the axis, the receiving stations to have a similar aerial and reflector system designed to have its maximum receptivity in the direction of the corresponding station.

The conditions in regard to the speed of working were

exceptionally stringent and severe. The stations for corresponding with Canada were to be capable of accurately sending and receiving, at the same time to and from Canada at the rate of one hundred five-letter words per minute (exclusive of any repetitions necessary to secure accuracy) during a daily average of eighteen hours.

The stations for communicating with South Africa were to be capable of maintaining the same daily rate of speed and accuracy for eleven hours. The stations working with India had to meet the same requirements for twelve hours, and those working to and from Australia for seven hours daily.

The Company was to give the Post Office a practical demonstration of actual working for seven consecutive days, which would prove to the satisfaction of the Government engineers that these severe conditions could be fulfilled.

On 18th October, 1926, the following letter was received from the office of the Engineer-in-Chief at the General Post Office.

BEAM AGREEMENT DATED JULY, 1924

The Preliminary Certificate

This is to certify that the sending beam station, erected at Bodmin for transmission to Canada and the receiving beam station erected at Bridgewater for reception from Canada have been submitted to seven days consecutive working and after making due allowance for the period during which the abnormal electrical storm was experienced, the stations satisfactorily fulfilled the conditions of being capable of sending and receiving at the same time to and from the Canadian Station one hundred words of five-letters each per minute, during a daily average of eighteen hours in accordance with clause 6 of the Beam agreement. This was signed T. F. Purves, Engineer-in-Chief. In March, May, and August of 1927 the Australian, South African and Indian stations passed their tests.

The effect of this, as Marconi points out, has not only permitted Great Britian to carry on a very efficient commercial service with her Dominions, but has brought about a reduction of telegraphic rates throughout.



[*Marconi Wireless Telegraph Co., Ltd.*

MARCONI (*centre*) WITH G. S. KEMP (*left*) AND P. W. PAGET (*right*) AT MARCONI HOUSE ON THE OCCASION OF THE TWENTY-EIGHTH ANNIVERSARY OF THE FIRST WIRELESS SIGNALS ACROSS THE ATLANTIC

"It has," Marconi says, "since the agreement been found that in regard to stations communicating with Australia, South Africa, and India, a daily average of over twenty hours of high speed communication is attainable, and that the spread of the beam is much narrower than had been specified in the Government requirements."

The remarks which Marconi made in regard to the great benefits of the beam system are completely endorsed by a letter sent on October 5th, 1927, by the Rt. Hon. W. Mitchell-Thomson, Postmaster-General.

The Imperial beam stations were opened after they had been fully tested, on the following dates: Bodmin to Canada, 24th October, 1926; Bodmin to South Africa, 5th July, 1927; Grimsby to Australia, 8th April, 1927; Grimsby to India, 6th September, 1927; Drummondville (Canada) to England, 25th October, 1926; Klipheuvel (South Africa) opened its beam station on 5th July, 1927, and Ballan (Australia) opened its station for communication with both England and Canada in April, 1927, five months earlier than Kirkee in India.

The completion of the beam agreement did not, however, conclude Marconi's experiments and tests in connection with beam wireless—there was too much yet to be discovered.

For example, in 1928 he remarked upon certain peculiarities in long-distance communication which he was investigating.

"It frequently occurs," he said, "that when the Canadian communication fades out for some hours on end, the other services to Australia, India, and South Africa, which use similar wave-lengths, continue working with undiminished efficiency. It has also been noticed that the times of bad fading practically always coincide with the appearance of large sunspots and intense aurora-boreali usually accompanied by magnetic storms, and at the same periods when cables and land lines experience difficulties or are thrown out of action." Marconi was much interested to find that other scientists had noted these peculiarities and that during these periods, signals could be received on a shorter wave-length than the one usually employed. It was said that these conditions might be due to the fact that during periods when sunspots and auroras were prevalent, conditions due

to the increased ionization of the atmosphere at a certain height are prevalent, resulting in the lowering of the ionized stratum which would produce an effect equivalent to what might be termed "intensified day-light."

In concluding this still incomplete survey of beam wireless, mention must be made of the part played in it by Marconi's laboratory at Marconi House, Aldwych. It was a room which had been specially fitted up and used by the inventor as a laboratory for some years. It was twenty feet long by twelve feet wide, and there was one large window which faced on to the Strand. Down one side ran a long bench, whilst in the centre there were several tables. At the end of the room farthest from the window was a sink with hot and cold water available and there was the usual laboratory equipment of Bunsen burners and electrical appliances.

No transmission work was carried out from this laboratory, but most of the apparatus used for transmitting from the *Elettra* was made there, or, at any rate, put through its preliminary tests there. With the aerial which was being used in 1924, Marconi could receive in this room practically all the American stations without any difficulty.

CHAPTER XIV

MARCONI IS HONOURED IN ITALY AND AMERICA

ON 13th June, 1926, all Bologna was *en fête*, for a celebration held in honour of the distinguished townsman, Guglielmo Marconi.

Streets were gay with bunting and many shops were decorated with devices which illustrated the progress of wireless. In several places, two poles had been set up and across a connecting wire, gay paper balls were set in groups of three, to commemorate the now famous transatlantic signal.

It was the thirtieth anniversary of his first patent and during the intervening years Marconi's visits to his home town had been infrequent. Bologna throughout history has been a cradle of Arts, and within its walls were born many whose names have gained immortal fame, among them the scientists Galvani and Righi.

In Marconi's honour, bands marched through the streets, there were cheering crowds, songs, banners and flags and all the vivid trappings of an Italian holiday.

The Bolognese restaurants were selling special "Wireless" and "Marconi" dishes, and once again "Spaghetti à la Marconi" was eaten with patriotic fervour. The culmination of the festivities lay in Marconi's speech to his fellow-citizens of Bologna, and this was delivered at the Old University, the Archiginnasio di Bologna. His arrival there had been announced by yet another wild outburst of cheering, from the crowds which had gathered around the ancient building.

Inside the University the enthusiasm was just as great, though it found expression in a less boisterous manner. As he frequently did upon such occasions he was wearing the uniform of an officer of the Italian Navy, and his fair colouring made him look less than his fifty odd years.

In the fine old hall with its stained-glass windows, the

sunlight wove a gay pattern of many colours, which all added to the impressiveness of the scene.

For a moment Marconi was moved beyond words by the tribute of the townsmen of this ancient city, but he composed himself and at length he spoke as follows:

"Since February, 1896, the date of my departure from Bologna, after my first experiment in wireless telegraphy carried out at the Villa Griffone, my life has been spent far from my beloved Bologna. The force of events has been greater than my will.

"Radio-telegraphy, which appeared to me destined to connect the thought of all the peoples in the world, demanded for its laboratory a very wide space indeed, and I chose the Atlantic Ocean.

"Bologna, the city which gave birth to Galvani and Righi, is always the home of him who has a reverence for study and progress. If in my work I have been carrying on for the last thirty years I have been carried far from Bologna, I hope that it has made me no less a worthy son of that city. No greater prize could be conferred upon one who ever feels the pride of having been born among you in our beloved Bologna. During my eighty-six crossings of the Atlantic, from farthest outposts in Canada, my thoughts have often been carried back here."

After referring to his early experiments at the Villa Griffone, he said:

"I remember how in both my boyhood and youth I was fascinated by the mathematical hypothesis of Maxwell regarding the electric-magnetic theory of light and the brilliant pursuit of such researches made by our great Bolognese physicist, Augusto Righi. For many years I had to face adverse criticisms, and the assurance from many distinguished as well as ordinary people that radio-telegraphy would never be in a position to compete seriously with other methods of communication. We Bolognese smile in the face of most difficulties. I was determined that success should crown my efforts eventually. In time, by means of the use of thermionic valves, a brilliant conception of Dr. Fleming, perfected by De Forest, Langmuir, and Armstrong in the United States, by Meisner in Germany, and Round and

Franklin in England; and by means of the use of balanced tuned circuits, of electric filters, of powerful amplifiers, and finally directional radiators, I succeeded in obtaining results such as to ensure regular wireless telegraphy service by day and night between Europe and America. Thus in 1918 I could for the first time in history communicate from England to Australia, over 20,000 kilometres. To obtain such a result, expensive installation is necessary, yet it was first at the Villa Griffone that I experimented with what has since come to be called beam wireless.

"In the early days at Bologna, it was my intention to develop this method of concentrating the radiation of electric waves in a beam, by means of suitable reflectors.

"In 1917, I used the first beam or 'fascio' apparatus, using short waves two or three metres in length, and perhaps I may be allowed to claim for this that I was the first fascist in Italy."

It is interesting to note that Marconi chose the *fascio* or Roman bundle, to characterize his concentration of electric rays for the purpose of propagating short waves, at about the same time as his eminent fellow-countryman, Mussolini, employed the same historic symbol to characterize binding together the forces of the nation to one unrelenting political purpose. The Marconi Fascio system was the first in the field.

He continued, that it took courage to say:

"Let us go back, after the expenditure of hundreds of millions on wireless stations; but the Bolognese, after building at Bologna one of the highest towers in Italy, did not hesitate to build near it, a much lower one. Near the longest-wave station had been constructed a short-wave one."

An even greater ovation greeted the conclusion of his speech than that which had been given to him when he arrived at the hall, accompanied by Signor Balluzo, Minister of National Economy, and a number of famous scientists.

The King of Italy wired to the Mayor of Bologna declaring that he participated in the great demonstration which was being given to that City's famous son.

Mussolini and Marconi, from their first meeting, have always been on most friendly terms. A few days after the

festivities in Bologna, Marconi returned to Rome to take his place in the Senate, as he was accustomed to do on many occasions.

The Duce, who entered the Chamber a few paces in advance of the inventor, met with a great ovation. Arms were flung upwards in the Fascist salute, but with a short and cryptic speech, Mussolini directed the ovation towards Senator Marconi.

Further honour was paid to Marconi by his own countrymen, in a great demonstration which took place a year later, in July, 1927. This time it was the Italian Navy who paid their homage. They marched from the Naval Arsenal at Spezia and formed a guard of honour in the Quadrangle. It was from this quadrangle, thirty years earlier, that Marconi carried out his first wireless experiments across water, in Italy, using a converted fishing-smack. A commemorative plate was unveiled in the presence of seven Admirals. Before the actual unveiling, a speech was made by Admiral the Duke of Monaco di Longano, the Commander-in-Chief at Spezia. He recalled the historic date, and explained how this had been the beginning of a great work which had benefited all kinds of seafarers, and most certainly the Navy. In return the Navy paid their homage to Marconi and honoured the work which he had done and the results which he had achieved.

This speech was followed by another, delivered by Marconi's friend the Marchese Solari, who was there as an officer in the Italian Navy.

Although in outward appearance and manner Marconi appears much more an Irish or Scotsman than an Italian, he is extremely proud of his Italian nationality, which as a young man he declined to relinquish, despite the desire which many of his English friends expressed, that he would become a naturalized Englishman. His is not a case where, "a prophet is without honour in his own country." He has been granted almost every honour that his grateful compatriots can confer upon him.

In the early days of the War he was elected a member of the Italian Senate, and has held this honour ever since, as it is, unlike our Cabinet Ministers, a life post, which

corresponds more with the position of Privy Councillor in England.

In June, 1929, he was created an hereditary Marquis by the King of Italy. In January, 1928, he was appointed President of the Italian National Council of Research, and on 29th November he became President of the Italian Royal Academy and member of the Supreme Council of the Fascist Party. In 1931, the Pope appointed him a member of the Pontificial Academy of Sciences. The honour was conferred after the Pope's first broadcast from the Vatican, to which millions of Roman Catholics all over the world listened. The Pope has had two micro-wave wireless stations installed in the Vatican State, one in the Vatican itself and the other at his summer home, the Castle Gandolfo, about twelve miles away.

Marconi has carried out some of his short-wave experiments between these two stations.

Another honour which the Pope has conferred on Marconi is the Grand Cross of the Order of Pius XI.

On the occasion of that first broadcast, Marconi said: "I speak in your most august presence, O Holy Father. The joy which this historic moment has given me is the greatest reward which I could have asked for my labours. Through my work, Your Holiness has deigned to make use of the electric waves to send across space words of Peace and Benediction to all the Faithful."

The Pope spoke in return, thanking Marconi and his collaborators and asking God's blessing upon the installation.

Marconi is a devout man of religion. He thinks that there is too much atheism abroad in the world to-day. He has replied to the recurring question: "Can a scientist be a believer in the Christian Faith?" definitely in the affirmative. He looks on science as one of the means of explaining some of the wonders which God has allowed in the world, and he believes that when the human brain is endowed with the ability to make great scientific discoveries, it is the will and direction of God. "The more a man bends the phenomena of the universe to his will and the more he discovers," he has written, "the more he will find to discover. Because of this he will realize more and more the infinity of the

Infinite." Such is his faith, nor have the multiplicity of his discoveries dimmed it.

Returning to England, we must look back a little, to a time before the Bologna festivities.

In August, 1925, wireless telephony was introduced for ships at sea. The apparatus which was used upon the *Princess Ena* for the Marconi Company experiments in linking up with land lines systems, was a set of quite small power, using only 400 watts. It was similar in principle to that already widely used, with which the actual wave-length can be determined according to requirements; no technical knowledge is needed for the switching on of the power, it puts everything in operation in the same way as the telephone does. This is the same as the duplex system of telephony, with which two subscribers can talk at the same time.

On 12th September, 1925, a luncheon was given at the Savoy Hotel, London, by the National Association of Radio Manufacturers and Traders, to inaugurate an Exhibition to be opened at the Albert Hall. When this Exhibition, the fourth of its kind to be held, was opened by Viscount Wolmer, M.P., then Postmaster-General, he described wireless as a kind of sixth sense or fourth dimension.

W. W. Burnham, Chairman of the Association, and Marconi were called upon for speeches. The latter said that he would always remember the part played by the Post Office in the expansion of wireless, also, he concluded, "The Art of radio communication is now undergoing a complete process of evolution, the future effects of which it was difficult to see at present."

Marconi's life work has seldom permitted him to remain for very long in one place; in fact, it is one of his jokes, that no sooner has he dealt with one thing, than another one crops up.

Thus his visit to London in the early autumn of 1925 was curtailed in order that he might attend the 11th International Telegraph Conference which was held in Paris on 30th September. As usual, he was enthusiastically received —in fact, upon his arrival at the Conference he was warmly

embraced by one elderly bearded wireless expert, a tribute which he received gracefully, if not altogether appreciatively, for unlike many Italians, Marconi is not given to publicly embracing his colleagues.

At this Conference there were many other famous inventors: Professor H. Abraham, Count von Arco, Hon. F. J. Bethened, Edouard Branly (of the coherer fame), Commandant Paul Brenot, F. J. Brown, Sir G. Clarke, J. C. Denison-Pender, General G. Ferrie, Emile Gurardean, Rear-Admiral Grant, Hon. M. Gredsted, Hon. T. F. Kramp (Denmark), S. Ljuerquist (Sweden), Col. Adrian Simpson, C.M.G., The Marchese di Solari, and many more.

It was at the People's Palace in the Mile End Road, London, that Marconi addressed a meeting of the League of Nations for the first time; his fellow-speaker on the platform was Lord Cecil. Both spoke of the great hopes of Peace for the future, and Marconi stressed, as he has so often done, on the work that he hoped wireless would do in binding together and creating better understanding between the peoples of all nations. His speech was enthusiastically received and a number of costermongers and their families cheered him loudly as he left the hall.

In April, 1926, he made a statement which was considered a most important one by the experts; he said:

"Hitherto wireless waves have been such that they could be intercepted anywhere, because they are propagated in all directions. I propose to radiate waves in one direction only; the experiments I have just carried out are only the first ones; I shall succeed finally in transmitting to America, for example, without interference or interception in travel."

During the years of 1925 and 1926, Marconi was not in his usual splendid health; he had had a severe attack of influenza and long hours of work and intense concentration had taken their toll; his health, however, was improved after a fairly long sojourn at sea, so that when he arrived in London, in the spring of 1927, his friends found him looking better than they had expected. Marconi is not so much wrapped up in the technical side of wireless that it becomes impossible for him to see its more frivolous applications. On the contrary, he is always the first to suggest any human

or amusing development. As a rule, these experiments are a success, but there was one at least which did not turn out according to plan.

On 22nd April, 1927, more than a thousand people attended the first post-war ball held by the Italian Benevolent Society, at the Savoy Hotel. The guests were much excited because they had been promised a surprise by Marconi (then in Rome). At first this remained a complete secret, but presently it leaked out that a most unusual radio entertainment was to be provided. Mussolini was to speak at midnight on the occasion of the three-thousandth anniversary of the foundation of Rome—and his speech was to be relayed to the ball-room.

The evening passed away happily enough with dancing and revelry, then the music ceased, and all eyes were fixed on the loud-speaker which had been installed and all ears were strained in keen anticipation; everyone was breathless —when a voice was heard. Someone commenced to cheer—then stopped suddenly, as puzzled expressions were seen on the faces of the Italians present—this was not the voice of Il Duce, for whom they had been waiting so eagerly. A few moments later the truth was disclosed. The engineers responsible for the relay found that they could not get Mussolini's voice from Italy, and as it was impossible to alter the arrangements at the last moment they had substituted a gramophone record of a speech delivered by General Diaz.

Marconi was not in England for some months after this date, partly for reasons of personal affairs. On 15th June, 1927, he was married in Rome to the Countess Maria Cristina Bezzi Scala, and went for a cruise on the *Elettra* later in the summer.

In May, 1928, Marconi, returning from a cruise, made an important announcement concerning beam wireless. He said: "I am experimenting with beam stations which can turn round. At present beam stations are fixed. America cannot be 'turned' on Japan, or vice versa. My tests have been with a revolving beam. If you want to transmit to a certain country, you turn it on those countries. Revolving stations are for countries without heavy traffic.

"The experimental transmitting stations," he said, "would for the present be Poldhu and the *Elettra*, either in the Atlantic or the Mediterranean." Thirty years after the first paid "Marconigram" was sent, these important experiments began. That is, in January, 1928, and they finally revolutionized transmission. Thirty years previously, when the transmission took place from the Needles to the Isle of Wight, the chief anxiety was as to whether experimenters were breaking the law. The Post Office claimed the monopoly of all telegrams. It was Lord Kelvin who decided that the risk should be taken, and early experiments went on.

The *Elettra* in 1928 was splendidly equipped for these far-reaching experiments, for only a year previously, in 1927, she had been refitted throughout and her equipment was without rival. Disappointments in transmission were frequent, but Marconi was, as usual, not to be deterred. He built up his experience out of his mistakes, and to his workers it seemed that he was never disheartened. This characteristic in him has always been his strength. Only an abiding faith in himself could have inspired him over a number of years to the unrelenting effort which has consistently marked his work. It is this faith in himself which has throughout the years inspired Marconi himself, but which has won for him the confidence of others. Throughout his career he has been lucky in the number of famous supporters he has always possessed, but in his earlier days, he also had some critics, who also ranked among the famous, among them the scientist, Sir Oliver Lodge.

It is indeed interesting to note how Lodge's criticisms turned to admiration and finally to friendship. This change of outlook is well illustrated by a remark which Sir Oliver Lodge made publicly in 1923, when he said: "When Signor Marconi succeeded in sending the letter 'S' in Morse signals from Cornwall or Ireland to Newfoundland, it constituted an epoch in human history on its physical side and was in itself an astonishing and remarkable feat."

Some of the sentiments which Marconi felt about Lodge were expressed in a speech which he made at the Central Hall, Westminster, when a presentation was made to the veteran scientist on behalf of *Popular Wireless*.

"Sir Oliver Lodge is, as we all know, one of our greatest physicists and thinkers, but it is particularly in regard to his pioneering work in wireless, which should never be forgotten, that we are all here to welcome him to-night.

"In the very early days, after the experimental confirmation of the correctness of Clerk Maxwell's theory as to the existence of electric waves and their propagation through space, it was given to only very few persons to possess clear insight in regard to what was considered to be one of the most important hidden mysteries of Nature, and Sir Oliver Lodge possessed this insight in a far greater degree than perhaps any of his contemporaries."

It will be seen from this and other instances that Marconi is always "big" enough to admire certain qualities in his critics, just as much as he would do if they were his friends. Like Edison he is a great believer in co-operation, and is therefore ever ready to listen to the opinions of others, and this is one reason for the lively interest which he takes in the affairs of the Royal Academy of Italy of which, it will be recalled, he was made president in November, 1928. Just why this Academy was instituted is explained in a speech which Marconi made on 23rd January, 1930, at the reception which the Academy gave to Dr. Garfield, President of William College and Director of the Institute of Politics at Williamstown (son of a former President of the U.S.A.).

Marconi explained that the Royal Academy of Italy was founded by Benito Mussolini and was, he considered, one of the most notable and positive achievements of Fascist Italy, and which has the good fortune to be housed in one of the most beautiful and significant buildings of the Italian Renaissance.

After explaining some of the chief objects of the institution he continued:

"Our Academy is still young, having been founded only about a year ago; but it is already in working order. We now publish volumes and papers on scientific subjects and we also direct and assist in the publication of many literary and artistic treasures existing in our numerous archives. We endeavour to co-operate with other academies and learned institutions, both in Italy and abroad, and often act

as advisers and counsellors when questions of art and science are under consideration, such as, for instance, the new bridge to be built across the Grand Canal at Venice."

The work of this Academy is very dear to Marconi's heart, and one can imagine the pleasure with which he told his audience: "Our Government has assigned to us the task of annually distributing, by way of encouraging arts and science, one million lire, and the Italian Edison Company has most generously instituted a foundation of eight million lire, administered by our Academy, for the purpose of enabling us to hold annual conventions, grant scholarships, and assist travel undertaken with the object of study and exploration." He also explained how an important Italian newspaper had instituted some important prizes to be called after Mussolini, and how the Italian Academy differed from many others because it embraced Literature and Art in its widest sense, as well as Science and the study of Antiquities. During the following year, on 21st April, 1931, the meeting of the Royal Academy was held at the Capitol in the presence of Their Majesties the King and Queen of Italy. Prizes were given, among them the famous Mussolini ones, amid much pomp and ceremony, added importance being given to the ceremony because it took place on "the Birthday of Rome."

Yet another instance of Marconi's thought for his fellow-scientists was contained in the Birthday Message which he sent to Vlademar Poulsen, on 20th November, 1929. "Mr. Poulsen's work," he said, "is known and honoured among scientists and inventors in all parts of the world."

By this time Marconi had become a figure-head of supreme importance in the radio industry; with David Sarnoff, head of the Radio Corporation of America, he became a Director of the Gramophone Company, yet none of these interests deterred him from continuing his heavy research work. During the next two or three years most of his activities and experiments were directed towards the perfection of wireless telephony, which everyone realized by now meant a complete revolution in the transmission of news and messages. On 21st March, 1930, he carried on a conversation by wireless telephone from the *Elettra*, which was

stationed in the Mediterranean just off Genoa, with Mr. E. T. Fisk, Managing Director of the Amalgamated Wireless Company of Australia, and others who were with him at Sydney, New South Wales, no less than 9,000 miles away. Two-way conversation from a ship over such a vast distance was indeed an achievement of great value, and it finally established the efficiency of the new wirelesss telephone apparatus. The report which Marconi sent to the Marconi Company about this, read: "This morning, by means of new Marconi ship wireless telephone apparatus, got through quite successfully and directly from *Elettra* to Sydney and had good two-way conversation with Fisk and others. *Elettra* transmitter proving most efficient."

There was keen anticipation when it was decided that on 26th March, a few days after the first telephone talk, Marconi should repeat the experiment and thus declare the Radio Exhibition in Sydney to be open. In Australia everything had been prepared for the moment by the Amalgamated Wireless Company. At Genoa, there was much suspense, though as usual, Marconi was fully assured of success.

First of all Mr. Matthieu began testing the short-wave radio transmitter in the early hours of the morning, and after many careful adjustments, decided that the instruments were sufficiently tuned and perfect for the experiments to be carried out. At this stage Marconi, who was looking rather serious (which is all the sign of emotion he shows on such an occasion), took his position in the Captain's cabin, where the transmitting apparatus was installed. He was wearing a blue yachting suit and white-topped cap, and from his appearance he might have been setting out on a pleasure cruise rather than upon an experience which was to make history.

The *Elettra* at this time was just outside the harbour of Genoa and the signals which were transmitted from the yacht were picked up at Dorchester, carried on from there to Grimsby, and were flashed by beam from Grimsby to Australia, where they were picked up at Victoria and carried by land line to Sydney Town Hall. Here it had been arranged that a switch would be operated which would turn on 3,000 lights at the same moment the inventor declared

the Exhibition open. Marconi, when the moment came, spoke over the 9,000 miles to Fisk, through what appeared to be an ordinary telephone instrument. Following this conversation he listened quietly, then at 11.3 a.m., exactly to time, a voice from Australia spoke: "The lights are on, thanks to you." During the week, further direct tests were made from the yacht. Afterwards Marconi learned that a gramophone record had been made of his voice in Australia, when it was relayed to Sydney at the moment when he declared the Exhibition open.

The efficiency of the new wireless telephone was thus amply demonstrated. The apparatus used in this case had been nearly all made at Chelmsford and was so compact that the complete installation could be placed with ease in the cabin of the yacht.

A month later, on 10th April, Marconi talked with the manager of the Argentine Wireless Company, 5,000 miles away, and in September the utility of short waves for long distance broadcasting was strikingly demonstrated by a most unusual broadcast which took place from the *Elettra*, when she was lying just off Civita Vecchia.

The Italian earthquake which took place in the autumn of 1930 had just laid waste the district, and journalists hurried from the scene of destruction to the *Elettra*, where they used Marconi's transmitting set to send their descriptions of the havoc to their papers in the U.S.A. This was the first time wireless had been used in this way, and it caused great interest.

Marconi followed this sensational demonstration of his new system with an interview, which took place between himself and others on his yacht and a group of men in a Fifth Avenue building in New York. This interview, which took place on 30th April, 1931, lasted thirty-two minutes and was rebroadcast throughout America.

In the huge building in Fifth Avenue of the National Broadcasting Studio, sat David Sarnoff, President of the Radio Corporation of America, M. H. Aylesworth, President of the National Broadcasting Corporation, Karl Bickel, President of the United Press Association and other men prominent in radio. Aboard the *Elettra* was the inventor

and his wife, Gaston Matthieu, his assistant, and Edward Storer, foreign correspondent of the United Press.

The conversation, according to American time, began at six o'clock in the evening, when Philip Carlin, assistant to the vice-president in charge of the programmes of the N.B.C., called the yacht, then 4,400 miles away. Immediately before this he addressed his American listeners: "Ladies and gentlemen, the National Broadcasting Company at this time will attempt another experiment in long-distance radio communication. Senator Guglielmo Marconi will speak to us from his yacht, the *Elettra*, which is somewhere in the Mediterranean Sea, the exact location to be learned later. We shall now attempt to establish communication with the *Elettra*. Hello!" called Mr. Carlin—"Is that Mr. Matthieu on the *Elettra*?" Upon receiving a reply from Matthieu, he asked, "Is Senator Marconi there?" Whereupon Matthieu continued, "Yes, Senator Marconi is here. Would you like to speak to him?" Then Marconi's quiet voice came through the ether:

"Hello, National Broadcasting Company, Senator Marconi speaking." Mr. Carlin then told Marconi who he had with him in the American studio.

Aylesworth was the next to speak; after a few other remarks were exchanged, he said to the inventor: "I am very glad to talk to you: we have a great thrill here in listening to you, almost a fourth of the way round the world. We want to congratulate you on the wonderful work you are doing and to say how happy we are to participate in these remarkable experiments.

"I am going to introduce to you one of our great Americans, Mr. Karl Bickel, President of the United Press; he is going to ask you a few questions which will not be embarrassing, but which will interest our American audience."

Marconi and Bickel then talked about the way in which the experiment was being conducted, when Bickel said:

"Senator, it is now four minutes after six in New York. What time is it where you are now?" To which Marconi replied: "Well, it is about four minutes after eleven o'clock at night." Bickel then recalled that in America they had



[*Marconi Wireless Telegraph Co., Ltd.*

SIGNOR MUSSOLINI AND THE MARCHESE MARCONI AT A SESSION OF THE ITALIAN ROYAL ACADEMY. MARCONI WAS APPOINTED MEMBER AND PRESIDENT, 19TH SEPTEMBER, 1930

daylight saving which accounted for the extra hour in the difference of time he had not thought of.

In reply to a query from Bickel as to Marconi's opinion on international broadcasts, the inventor replied: "I strongly believe in the exchange of international broadcasts and that it will improve and consolidate existing friendships between the nations of the world. I believe it will promote a mutual understanding of our respective feelings, habits and ideals and help us to comprehend and appreciate our various points of view. This again will certainly be a big factor in the promotion of World Peace and should make the possibility of war always more remote." Bickel's agreement with this statement was followed by a query as to how soon America might hope for broadcast programmes from Italy.

"Soon," admitted Marconi, "and I am confident that the American public will not be disappointed in their expectations when they do receive programmes from Italy. The first short-wave Italian broadcasting station near Rome is practically completed. Its official opening is now only a matter of days." Marconi then described the type of programmes which would be broadcast from Italy, and the feeling of the Italian people towards international broadcasting.

Bickel asked if Marconi still felt the same tremendous enthusiasm for the development of radio as he had done when he first began his experiments, to which, of course, he received a very definite reply that his enthusiasm would remain as long as he was still alive.

After replying to questions regarding the wireless installation in the Vatican City and other stations to be opened in Europe—Bickel asked: "Has television in Europe been put on a practical basis?" This was the first time that Marconi had been asked to make any statement about television publicly, and his reply was typical of his cautiousness in making announcements. "It depends what you mean," he said.

Bickel, with all the grim determination to get his story, which is common among American journalists, continued: "Do you think that television will be as general as radio broadcasting to-day in the near future?"

"Yes," said Marconi, after a brief pause, as if to consider his words carefully. "Several European broadcasting stations transmit television daily, and it is now a practical proposition for the followers of this new art to enjoy all that the present state of development of this new means of communication can offer. I am not sure that television will ever be in such general use as radio broadcasting is to-day, and I think it is too early for anyone to give an authoritative answer to this question. It seems to me that in comparison with ordinary broadcasting, the utility of television is likely to be limited." He continued in reply to Bickel's further questioning with regard to television.

"Yes, certainly I think the day will come when we shall be able to see one another whilst talking as we are now. I believe that even with the present development of the art, with exceptionally good transmission, the feat might be possible to-day. I sincerely regret that we have not the necessary installation in connection with our present circuit, so that I might have the pleasure, not only of speaking to you, but also of seeing you and all our American friends right now."

When Marconi had finished talking to, or rather being questioned by Bickel, he put Edward Storer on to talk to his Press colleague. Afterwards Carlin had another conversation with Marconi when he asked him if he did any fishing on his yacht.

Marconi laughed at this inquiry and told Mr. Carlin he often caught enough fish from the yacht to last them for days. He also admitted that neither he or the Marchesa Marconi were troubled by rough weather.

Having completed, as he said, this conversation about the more intimate things of life, Mr. Carlin handed the microphone over to David Sarnoff. Both Marconi and his wife, in turn, talked with Sarnoff, who remarked to the inventor: "I am sure there would have been no Radio Corporation if there had been no Marconi." At the conclusion of their chat Sarnoff said: "Senator, before we close off and go back to work, I would very much like you to say a word to our two engineers who have had such a thrill this afternoon, and have worked so long on it."

Marconi expressed his pleasure at the idea of talking to the men, with the result that C. W. Horn, general engineer, and O. B. Hanson, manager of plant operation and engineering of the N.B.C., discussed the technical side of the broadcast with Marconi.

Then Carlin wound off the proceedings with a touch of humour: "Senator Marconi," he said, "everyone has spoken around here that wanted to speak, and I suppose you will say I have the worst voice of the lot, because I am supposed to be the Announcer—but then you see I am just a New York boy and my accent is not as good as the rest of them," which made Marconi ask him if he came from New York and what part of the city. Carlin was amused at this and admitted to Brooklyn, though adding: "I don't want to brag about it." Thanking Marconi again for all the trouble he had taken, he ended what he described in his final words—as "our little love-feast."

So, with the quality of speech excellent all the way through, concluded one of the most interesting broadcasts which has ever taken place anywhere, for it showed the amazing power of wireless to conquer distance—linking together, with the sound of their voices, friends separated by thousands of miles.

After the success of the lighting of the Sydney Exhibition, it is not surprising that Marconi was asked to inaugurate another famous illumination, this time of a totally different nature.

The illumination of the statue of Christ on the Corcovado Mountain, near Rio de Janeiro, was the subject. At first it was arranged to do this by means of a wireless signal from Rome at 9.15 a.m. Greenwich Mean Time, on 12th October, 1931, but afterwards the arrangements were altered slightly and the station at Coltano, near Leghorn, about 150 miles from Rome, was eventually used, a station which has now been renamed the Guglielmo Marconi Station. A Morse signal was transmitted on two wave-lengths of 45.11 metres and 23.24 metres and the illumination successfully effected.

Previous to this date, suggestions had been made that one day a year should be put aside to give special honour to Marconi and his inventions, as it was more or less decided

that the day of his birth would be the most applicable date. Because of this, on 25th April, 1931, congratulations were broadcast from many countries, though it transpired later that Marconi Day was not officially inaugurated until 1933, when it was decided to make the date October 2nd. However, in 1931, on the instigation of the American Broadcasting Company, a roll-call of sixteen nations, then broadcasting, took place, which roused the enthusiasm of Japan. Mr. Inada, who spoke for his country in the course of a "world broadcast," expressed his joy and the honour his country felt in being one of the sixteen nations to broadcast. Speakers from New York rebroadcast the messages over a network of stations and routes all over the world, and the "roll-call" lasted two and a-half hours from 9 p.m. David Sarnoff was the moving spirit of the experiment, which did much to publicize wireless telephony.

By this time, Marconi had become a hero in America, as he had been for years in Italy and Great Britain, and so it was no surprise to the American public when in March, 1932, he was awarded the John Scott American Prize. This ceremony took place at the American Embassy in Rome, and in the course of an address the American Ambassador explained that this award was accorded him by the city of Philadelphia in recognition of the great service which he had done the world when he invented wireless. The meeting was attended by members of the National Council of Research and the Royal Academy of Italy.

CHAPTER XV

MARCONI WORKS ON SHORT WAVES

PROGRESS in the application of telephony to wireless had been very rapid up to 1930, when world-wide recognition of its possibilities was made by such schemes as illuminating distant functions and organizing contacts circling the globe.

Marconi's discovery had extended far beyond the limits of any fields of application ever dreamed of by his most enthusiastic supporters in the early days of his experiments.

To the inventor himself, this vast expansion of his discovery appeared in a totally different light, to him it was the realization of the visions which he had seen so clearly, in those quiet hours of contemplation, which he spent in the summer of 1894, among the mountains of Biellese. In those days, when he concentrated so closely upon all that Hertz had already achieved—except to his mother, to whom he confided every hope—he never spoke of his ultimate aims, apparently he preferred to get on with the actual work in hand at the time.

However, by 1930, it was possible to look back and note the great landmarks in the progress of wireless from the first signals across the garden of the Villa Griffone.

Thirty-four years of progress:—

1896	Salisbury Plain	1¾ miles.
1897	Salisbury Plain	4 „
1899	England to France ..	approx. 23 „
1901	Poldhu to Newfoundland ..	1,800 „
1902	Poldhu to Canada	2,000 „
1905	Poldhu to Cape Cod ..	nearly 3,000 „
1909 (Sept.)	*Principessa Mafalda* to Clifden and Glace Bay	about 6,000 „
1909 (Oct.)	Buenos Aires	over 6,000 „
1910 (Jan.)	Punta Arenas to Liverpool ..	7,300 „

1922	First Broadcast from the British Broadcasting Co.	—
1924	England to Australia (Telephony Test)	approx. 12,000 miles.
1925	Daventry Station opened ..	—
1927 (Jan.)	The General Post Office Transmitting Station at Rugby was brought into use	—
1929	First official experiments in television made by the B.B.C. ..	—
1930	Broadcast conversation between the *Elettra* and New York..	—

Throughout 1930 Marconi spent the greater part of his time in Italy, for one reason he wished to conduct a number of experiments from the yacht. For another reason the Marchesa Marconi was not in very good health and he did not wish to take the yacht out of Italian waters. . . .

During his constant visits to Rome, he spent much time at the Royal Academy, which had already achieved a good deal in the world of art and science, as Marconi had previously anticipated it would do.

As usual, there was a fair sprinkling of foreign scientists among those who attended the University.

On 11th September, 1930, Marconi gave an address at Trento, on the occasion of the Nineteenth Meeting of the Italian Society for the Progress of Sciences, which revealed the steps leading to this startling development, so rapidly commercialized in the United States. The address dealt with "Phenomena accompanying Radio Transmissions."

He spoke of his first signal across the Atlantic, which convinced him that in all probability no distance would be too great for wireless to cover. "At that time, however," he said, "there was lacking a rational theory explaining how these electric radiations could follow the curvature of the earth and reach most distant countries. Several physicists and mathematicians (among them Rayleigh, who in 1903 read a paper on the matter before the Royal Society in London), referring to the results which I had obtained at distances of several thousands of kilometres, demonstrated by calculation

that such results could not be explained by the phenomenon of distraction pure and simple. Other experiments which I was able to carry out in the Atlantic on the S.S. *Philadelphia* during the month of February, 1902, enabled me to discover another phenomenon of certain importance—that with waves of about 2,000 metres the distances over which transmissions could be carried out were several times greater during the night. This indicated either an absorption of the energy of the electric waves caused by sunlight, or a variation in the conditions which permitted the waves to reach the greater distances.

"The mathematician Heaviside in England and the physicist Kennelly in America were the first to put forward the hypothesis at once universally accepted, that at a certain height (at that time not well determined) there must exist a state of ionization of the atmosphere, or a conductive layer, constituting a kind of envelope concentric to the surface of the globe, which envelope was capable of reflecting or deflecting the electric waves in such a manner as to compel them to follow the curvature of the earth, impeding their radiation and their loss into infinite space. The hypothesis of Heaviside was studied and amplified by many scientists, among them Poincaré, Rayleigh, Thomson, Macdonald, Sommerfield, Zenneck, Eccles, Appleton, Eckersley, and many others. Loewenstein in a paper expressed the hypothesis of the existence of three layers which could influence the propagation of electric waves, one at a height of 11 kilometres from the earth and the other two at 75 and 220 kilometres respectively. This hypothesis approximates to the more modern ideas which not only suppose the existence of manifold zones and layers capable of reflecting or bending the electric waves, but also that these zones vary in height and distance from the earth at different hours of the day, with the seasons, and according to their ionization or composition due in turn to the effects of light, to the electric and magnetic activity of the sun and perhaps to other causes still unknown.

"The determination of the height of the reflecting or refracting layers has been, and continues to be, the object of laborious study on the part of patient investigators, among them Breit, Tuve and Dahl, Kenrick and Jen, who have

submitted interesting papers regarding the matter to the Institute of Radio Engineers in New York. The influence of these layers or zones would explain the variations of range and intensity of the various electric waves according as they are propagated across illuminated or dark zones, or when special conditions of solar activity prevail; from which it consequently results that the alternation of the seasons and the light of day with the darkness of night constitutes an element of the very first importance for the determination of the waves most suitable to radio transmission across given distances."

Marconi went on to discuss the discovery of the short wave and the world-wide range of action opened up by it. "In view of the velocity of electric waves," he stated, "which is approximately 300,000 km. per second, the transmission of signals even by the longest route, does not, of course, involve any appreciable delay, the reception being, for all practical purposes, instantaneous. Signals which evidently went completely round the world were noticed by one of my assistants, Langridge, in July, 1925, while he was listening at Brentwood, England, to the signals transmitted on a wave of 25 metres from the Poldhu station. An interesting and accurate study of these phenomena was made in 1926 by Quack who put on record the frequent recurrence (in short wave radio communications) of the perception of a secondary signal or duplicate of the signal immediately after the reception of the principal signal. From measurements carried out by Quack on the basis of the duration of the interval of time between the principal signal and the reception of the secondary signal, it would appear that the waves in going round the globe cover a course of 41,200 km. The fact that this course is somewhat greater than the circumference of the globe would indicate that the electric waves undergo reflections or refractions between a reflecting layer and the earth or that they describe a maximum circle around the earth situated at a height of 182 km. It is to be noted that the transmissions which take place with the more distant countries, for example, those near the Antipodes, are effected very often with greater facility than transmissions with countries at intermediate distances, relatively nearer.



[*Bertram Park, London*

H. E. THE MARCHESA MARCONI

"A phenomenon which has aroused great interest among students is that of repetition of signals or electric echoes, which takes place specially with waves of a length lying between 14 and 20 metres. I premise that these echoes, however interesting they may be from the point of view of scientific research, are not in fact liked in radio-telegraph stations for the reason that the repetition of signals often tends to confuse, or at least to render less clear, the reception of messages. Much study has been given on the *Elettra* and elsewhere both to observing the effects of so-called echoes and to thinking out suitable devices for suppressing them.

"In 1928, Prof. Stormer, also of Oslo, announced that he had been able to confirm the observations made by Engineer Hals with regard to the existence of radio echoes received several seconds after the transmission of each signal, in view of the fact that the velocity of electric waves causing the echo traverses in certain cases hundreds of thousands of kilometres. In the course of a lecture given at Edinburgh in February this year Prof. Stormer expressed a doubt as to whether some of the waves used in the various transmissions were reflected by the orbit of the moon.

"The hypothesis of Stormer is that these waves are reflected at a great distance from the terrestrial globe by electric strata or by electrons projected by the sun. Electrified particles, which emanated from the sun and happened to be under the influence of the terrestrial magnetic field, would be bent round in a toroidal zone at a great distance from the earth. According to Pederson, electric echoes can also be obtained which would indicate that the reflecting layer or zone may even at a distance of 40 million kilometres from the earth. Engineer Hals has reported that he has observed these echoes after intervals of 3 min. 15 sec. and even 4 min. 20 sec. If we always bear in mind the fact that the speed of electric waves is 300,000 kilometres per second, these observations would indicate that the distance traversed by these waves is 58,500,000 and 78,000,000 kilometres respectively.

"If this is true, what enormous progress has been made since my first experiments when those same waves could

be perceived at a distance of about 20 metres at the most. It should be recalled that some physicists, such as Van der Poldeny, agree that electric waves can go outside the terrestrial atmosphere and thus traverse enormous distances. They explain the delay in the echo or return signals by the hypothesis that this is caused by special electronic distribution of the Heaviside layer capable of greatly reducing the group speed as compared with phase speed. Several scientists do not agree, among them Pederson. I am rather favourable to the hypotheses of the latter since I do not see the reason why there should be excluded the possibility of waves of a certain frequency transmitted by us crossing the Heaviside or other layers, since these layers are all crossed by a multiplicity of phenomena, effects and waves which reach us from the sun, primarily among them heat and light.

"In order to explain the phenomenon of the transmission of electric waves to long distances on the earth the hypothesis is necessary not only of a single conducting, refracting or reflecting ray, but the electric waves now used in radio transmissions.

"Observations on the behaviour of waves longer than 10 metres seem to have established the fact that they are not confined to a restricted space near the earth. In the modern practice of radio communications echoes have already a considerable importance. If they do not exert a seriously prejudicial effect on the radio-telegraphy and radio-telephony, they nevertheless exert a deleterious effect on the radio transmission of pictures and in long-distance television, because these repetitions of impulses and signals tend to obscure and confuse the pictures."

It was during this lecture, and at this point that Marconi made another reference to television. He said to that distinguished gathering:

"I am certain that the progress recently obtained in the stabilization of frequencies and in the transmission and reception of beam waves will tend towards surmounting the difficulties which still stand in the way of the practical realization of long-distance television. The great conquests already made allow us to assert now with certainty that by means of electric waves mankind not only has available a new and

powerful means of scientific research, but it is conquering a new force and utilizing a new arm of civilization and progress which knows no frontiers, and can even push out into infinite spaces where never before has the feeling of any manifestation of the activity and thought of man been able to penetrate."

To-day Marconi is more interested in the possibilities of micro-waves than in any other aspect of his vast researches. Already we know that these waves are being largely used by the medical profession, and it was for this reason that he was asked to preside over the Radio Biological Conference at Venice in the summer of 1934. It is a fact that some headaches are greatly alleviated by micro-wave treatment, as also is rheumatism in many forms.

At the Royal Institution of Great Britain in 1932 he described some of his experiments and discoveries in the field of micro-waves. Dealing with the results of his recent investigations into the properties and behaviour of very short waves, he said: "The remarkable results which I obtained during the period 1919-1924 with the use of wave-lengths from 100 to 6 metres, which led to the collapse of the Imperial long-wave scheme and the substitution of high-speed short-wave beam transmission distracted my attention from the study of micro-waves. Electro magnetic waves under one metre in length are usually referred to as quasi-optical waves, the general belief being that with them communication is possible only when the two ends of the radio circuit are within visual range of one another and that in consequence their usefulness is defined by that condition.

"Long experience has, however, taught me not always to believe in the limitations indicated by purely theoretical considerations or even calculations, for these, as we well know, are often based on insufficient knowledge of all the relevant factors. It is better to try out new lines of research, however unpromising they may appear at first sight. It was about eighteen months ago that I decided again to take up the systematic investigation of the properties and characteristics of these very short waves in view of the palpable advantages which they seemed to offer. That is, small dimensions of the radiators, receivers and reflectors

necessary for radiating and receiving a considerable amount of electric energy, and in view also of the fact that they do not suffer interference from natural electrical disturbances such as are called atmospherics or 'static.' "

Marconi described the apparatus in detail, illustrating his description with lantern-slides, which made public for the first time all the special features of designs of his new micro-wave transmitting and receiving equipment. Experiments of these waves were carried out over a short distance, then a longer one. Soon afterwards a duplex demonstration was held over a distance of twenty-three miles between Santa Margherita and Sestri Levante, and between the Vatican City and the Pope's summer residence, the Castel Gandolfo, this despite the fact there were many trees and small buildings intervening along the route.

Following a series of experiments with waves of the order of 50 centimetres length, conducted between the *Elettra* and the station at Rocca di Papa, near Rome, the most outstanding result of all his tests was the successful establishment of communication from Rocca di Papa to Cape Figari, Sardinia, over a distance of 168 statute miles on a wave-length of 57 centimetres. Not only were all previous distance records of communication by means of wave-lengths below one metre far surpassed but it was effectively demonstrated that these very short waves could overcome the supposed obstacle presented by the curvature of the earth. The distance between the two stations was of course considerably in excess of the optical range.

In his speech before the Royal Institution, he said: "I feel I may say that some of the practical possibilities of a hitherto unexplored range of electrical waves are being investigated and a new technique, which is bound to extend very considerably the already vast field of the application of the electric waves to radio communication." When this was developed, he explained, it would mean radio service and entertainment free from atmospheric interference. It would be useful for communication between islands and over short distances. Micro-waves were unaffected by fog and offered a high degree of secrecy, the latter principally by their sharp directional qualities.

"In any case," he said, "a system is now available for replacing optical, or light, signalling in all its long distance applications such as broadcasting and television. When these waves have been studied further it is difficult to tell yet in what new fields they may be applied."

Some few weeks after this, there was, as many will remember, a collision between H.M.S. *Glorious* and the French liner *Florida*. Referring to this accident, Marconi said: "Had these ships been fitted with an ultra-short-wave installation for communication, this collision would not have occurred. The point being that, although they will not pass through an obstacle, they will not get mixed up with other waves."

In the midst of his researches, a British honour was offered to Marconi which, out of his deep respect for Kelvin—"Kelvin always believed in me," he often said—afforded him great pleasure. In the Great Hall of the Institution of Civil Engineers, Marconi was presented with the Kelvin medal for 1932, by Lord Rutherford. Sir Cyril Kirkpatrick, President of the Institution, was in the chair, and among those present were the Marchesa Marconi and the Italian Ambassador. This was the fifth triennial award of the medal, and in every case when the award has been made it has been to men engaged in the kind of work for which Lord Kelvin lived. Among those who had already received it were Dr. W. C. Unwin (Great Britain), Professor Elihu Thomson (U.S.A.), the late Sir Charles Parsons, Mons. Andre Blondel (France), etc.

The death of Edison on October 3rd, 1931, ended a friendship which had lasted for more than thirty years. During those years Marconi made innumerable visits to America, and it was not possible for him to see Edison every time, but whenever he could he made a special point of seeing him, when both men would discuss their latest experiments and discoveries and compare notes, for according to Marconi, he never met Edison and found that the older man was without something interesting to say. There was, however, a point upon which they never agreed; that concerned working hours and meals. Edison, once engaged upon an experiment, objected to leaving it until he had either achieved what he had set out to accomplish, or could judge

just how it would ultimately turn out. It only annoyed him if he were interrupted for meals, a fact which used to worry Mrs. Edison greatly. She had to employ a great deal of tact and patience in order to get her husband to take the nourishment necessary for his health, especially as his advanced years began to take their toll. Marconi always stuck stolidly to his point. "I like to have my meals at their proper time, Edison," he would say, with a twinkle in his eye, and very probably memories of that Sunday long ago at Orange, when lunch had been such a difficult affair.

At the time of Edison's death, Marconi said: "Thomas Edison, to whom the whole world is indebted, was a constant inspiration to me throughout my life."

Another tribute he paid to him at the same time: "Edison's death is a great loss, not only for science and to people in the United States, but to all classes of people and to the whole world. Everyone will unite, at this time, in expressing their sympathy as well as sorrow, as well as their admiration for the character and work of the man. I personally, very deeply deplore his loss."

As far as records can be relied upon, the last occasion upon which Edison took an active part in an experiment carried out by Marconi, was when an address was given by Marconi on 23rd January, 1930, to two important meetings at the same time. The World Power Conference in Berlin and the National Electric Light Association Conference in San Francisco, held, of course, in places nearly 6,000 miles apart.

There were seven speakers, all men prominent in international affairs in different parts of the world. Marconi and Lord Derby spoke from England, Edison, Owen D. Young, and Matthew Sloan from the United States, and Dr. Carl Koettgen and Dr. Oskar von Miller from Germany.

The speeches were transmitted across the Atlantic by the Rugby-New York wireless telephone service, and between London and Berlin by land line telephone. In the U.S.A. the speeches were broadcast from all the stations of the N.B.C.

Marconi's speech was relayed simultaneously to both Conferences; he spoke, of course, in English and said:

"I greatly appreciate the honour of being permitted to

join the very distinguished speakers who to-day from various separate and distant parts of the earth, are addressing members of the World Power Conference, assembled in Berlin, and members of the National Electric Light Association, who are holding their Annual Convention in San Francisco, California.

"This participation has been made possible by the great advances in radio and telephonic communication which have now come into active being and which have already linked up the world in a way which we never experienced before.

"This linking-up of different countries together with the means of utilizing and distributing electrical power and the transport of power over great distances has only been achieved by the co-operation of scientists, engineers and the industrial organizations as well as the governments of many countries.

"We are perhaps only beginning to realize the full benefits the world can reap from true co-operation between the industrial organizations of the civilized peoples of all lands. Without denying the stimulus of healthy competition, it is my humble opinion that the human race will benefit to a still larger extent by a truly honest and rational co-operation, of which these great meetings are such a luminous example.

"Some radio tests which I carried out last March between my yacht, then at Genoa, and Sydney, Australia, somewhat erroneously brought before the popular mind the possibility of the transmission by radio, of electrical energy through space over a great distance. This, however, is not possible at present, but radio is nevertheless now sending power to and fro across the world in ever-increasing amounts. It is the greatest power we control, even greater than the power of electrical energy. It is the power of the human mind. The power of love and of thought. The power of our best thoughts must be the true carrier of civilization and efficiency, the power which should for ever tend to promote and cement goodwill and co-operation between nations, and which I firmly believe is inevitably destined to prevent the horrors of war by bringing about more perfect understanding between all peoples."

He concluded his address with words specially intended for the ears of the veteran Edison :

"I wish to send my salutations and regards to my friends and to my co-workers in radio in both America and Germany, and also, if I may be permitted, my most respectful greetings to Mr. Thomas Edison. Mr. Edison, through his innumerable inventions, and particularly by that of the incandescent lamp, has brought light and cheerfulness into countless homes, beside showing us the way to utilize enormous amounts of electrical power for the benefit of mankind.

"I, personally, shall never forget the encouragement and friendship Mr. Edison so generously extended to me in the early days of my work. I am glad to be able to wish him, through space, the continued good health and happiness he so thoroughly deserves."

CHAPTER XVI

MARCONI THE MAN—HOME LIFE

WHAT is the outstanding difference between Marconi, the world-famous inventor of to-day and Marconi, "the shy young Italian" who first came to England?

In those early days he intensely disliked having to meet strange people; his greatest pleasure was to ride his bicycle through quiet country lanes, whether it happened to be England, Italy or Ireland. He always avoided any action which would disclose to people who he was, and sometimes this led to amusing adventures, such as one which befell him during one of his early visits to Ireland, where he went to stay with his mother's people. This was prior to his first signals across the Atlantic, but owing to his associations with the country, a good deal had appeared in the Irish papers about his discoveries and experiments.

He had slipped into a quiet inn for a meal, and found only one other man having something to eat, and at the same time reading a paper which referred to Marconi's tests in England.

He looked up when the inventor entered and smiled, later he got into conversation with him, and one of the first questions he put to the young man was: "What do you think about this young man's ideas?" "Oh, there may be something in them," said Marconi, looking towards the ground to hide the twinkle in his eye. "Something in them," exclaimed the Irishman angrily, "I should think there *is* something in them, and a lot in them, and what is more, mark you, young man, there will be a great deal more heard of this invention in years to come." Naturally, Marconi did not attempt to argue the point, but quietly acquiesced.

He still rather enjoys remaining incognito, and hearing what people have to say about him, but he is not often able

to do this, his photograph has appeared too often in all corners of the globe.

It was after his early sojourns in Ireland that he first took up horse-riding, as an occasional change from cycling, and as the years went by, he became a great horse lover and also quite an accomplished horseman. In London before the war, he was often to be seen riding in the Row, usually very early in the morning and often entirely alone. As has already been recorded in this story, motoring and aviation have both played their part in his life, and to-day in Italy, he still enjoys motoring, despite the terrible accident resulting in the loss of his eye which would have deterred most people from ever driving a car any more.

"The roads in Italy have been much improved since those days," he makes his excuse when people compliment him upon his courage in still driving a car. However great the lure of the open road may appeal to Marconi, the vast expanse of seas and oceans appeal to him even more. He has said again and again throughout his life: "If fate had not made me an inventor I should most certainly have been a sailor." Truly he is cut out for one; the fiercest storm leaves him perfectly calm. On board the *Elettra*, all his crew realize that their chief knows as much about navigation as they do, in most instances a good deal more. Almost throughout his entire career, Marconi has been entitled to the rank of officer in the Italian Navy, and certainly some of his happiest memories are of those days when he was aboard the *Carlo Alberto* with Admiral Mirabello.

During his life he has had many honours conferred upon him, possibly more than any other man alive to-day, yet he was delighted in July, 1932, to be promoted to the rank of Captain of a vessel. On that date he received the following intimation from Admiral Sirianni, Minister of Marine Affairs:

"The Navy is proud to count you among its officers."

It is probably owing to his love of the water that Marconi made a certain stipulation when the Marconi Company removed their offices, in January, 1934, from Marconi House, in Aldwych, to "Elettra House" on the Victoria Embankment. "Let me see," he said, "the sun shining on the water

on sunny days, and hear the hooting of the tugs, as they pass up and down. It is a sound I like to hear—a reminder of the great ships which are ever setting out on their ocean journeys."

As a matter of fact, Marconi's private office in which he sees visitors when in London is not the vast sumptuous room one might expect to find occupied by so important a man. It is not a very large room, and the furnishing is quiet and comfortable, not in the least ostentatious, but from the window, there is—"a fine view."

It is typical of Marconi that in this huge up-to-date modern building he often passes along the endless passages, unnoticed by all but his personal staff, who always welcome even a passing glimpse of their Chief, affectionately known to them (not in his presence, of course), as G.M. He prefers not to be recognized by strangers—but to be allowed to continue his way uninterrupted.

Unlike many scientists, Marconi is a good business man, a point which accounts in a measure for his discovery of wireless and its possibilities, when other learned and older men had followed the same line of thought and inquiry without arriving at anything very definite. Marconi did not consider what scientific tricks might be played with electric waves, or what peculiar behaviour they might show under certain circumstances. He wanted something practical—to be able to establish communication between human beings who wished to communicate with one another without the intervention of mechanical contrivances, and he succeeded. His first thought after he had tried out an experiment is how can it be applied either commercially or for the benefit of mankind. It is probably from his Scots ancestry that he inherits this business instinct, though he is always sufficiently an idealist to put progress before financial considerations. If some improvement necessitates the scrapping of an expensive plant—Marconi will not hesitate—the plant must go.

He is not a man who can be described as "easy to know"; his character is too complex for that, even those who have known him for very many years are surprised to discover

some characteristic of which they were previously totally unaware.

In some way his disposition is contradictory, for example, he likes punctuality. If he makes an appointment with a man, and the man is ten minutes late, he need not expect a sympathetic hearing from Marconi. He is punctual himself, also he likes to do things by routine. Breakfast at 8 a.m. is a hard-and-fast rule, wherever he is; on the other hand, he dislikes to be hurried over anything, and the man who attempts to "rush" Marconi into anything is doomed to disappointment from the outset.

Sometimes he is rather the despair of those who work around him because of his intense application to detail; the criticism is sometimes made that he might just as well leave a number of small things to be attended to by those in his employ, but those who make such suggestions entirely overlook the fact that it is Marconi's care of every detail which has brought such great success in all his achievements.

Upon first acquaintance his expression is a little aloof, for despite the vast number of people whom he meets both in connection with his work and socially he still has that deep-rooted objection to strangers, but this first coolness of manner soon wears off, and his kindness of heart makes it impossible for him not to put people at their ease, especially if he finds that they are at all nervous.

Marconi has a very keen sense of humour, and a ready wit which surprises, because he suddenly makes a *bon mot* when least expected. An old friend, in describing Marconi, said he combined the warm-heartedness of an Irishman with the caution of a Scot and the subtlety of an Italian; they might have added that he possesses the combined courage and "grit" of all three for every step in his career has proved that once he is set upon accomplishing a feat, nothing will turn him from his purpose.

Marconi always dresses in good taste and looks more like a Britisher than an Italian—never is there a suspicion of the absent-minded professor about him.

When he is in Rome, Marconi lives in the Via Condotti, an historic district of Rome, where there are many fine

buildings and houses, and not far away there is that lovely park which is one of the many things in their city of which the Romans are justly proud—the Pincio.

Here he and his young wife entertain many men and women famous throughout the world of Art and Science.

It was in April, 1927, that he became engaged to the Countess Maria Cristina Bezzi Scali, the then twenty-three-year-old daughter of Count Francesco Bezzi Scali, Brigadier-General of the Papal Noble Guard. On 15th June they were married. After his marriage, Marconi continued to live in his yacht, because the Marchesa is just as fond of the sea as he is, and enjoys every moment of the sunny hours she spends on the *Elettra*. After a while, however, they were both agreed that it would be good to have a country home, in addition to the family seat at Bologna, because although the Marchesa was charmed with the Villa Griffone and all its wonderful associations with her husband's career, it was inconvenient owing to its distance from Rome, to which city Marconi is so often called by business connected with the wide field of his experiments, at short notice. So it was decided that they should spend a good deal of their time in summer at the Odescalchi Palace, at Civita Vecchia.

It was here that their daughter was born on 20th July, 1930, and they both decided that she should be called "Elettra," a name which had come to be associated with all that Marconi held most dear.

It would be difficult to imagine a more romantic corner of old Italy than Civita Vecchia, a rather dilapidated Italian town, which can be reached by car from Rome in about an hour, that is if the driver is as good as Marconi. To make matters easier, there is a magnificent motor-road between the two places.

To the lover of old places, Civita Vecchia is a beauty spot, for the winding narrow streets are full of odd corners, houses built so close to each other in some places that they throw heavy shadows whilst the sun is shining brilliantly in the blue vault of the skies above—in such shadowy corners that make the visitor dream of romantic love affairs and

vendettas, such as are believed to flourish in Italy more than in any other country, but are often only the result of tradition and a vivid imagination. In parts the old town is very hilly and quaint flights of steps from one street to another add to the picturesque effect, whilst here and there between the uneven rows of houses can be seen the smooth shimmering expanse of sea, blue as the heavens which it reflects.

The Odescalchi Palace is situated on a small promontory jutting into the sea; the fine gardens which surround it are laid out in terrace after terrace, right down to the shore. On still evenings, the gentle lapping of the waves on this shore can be heard in the palace; on late summer evenings when the moon sails high in the sky, the palace stands like some ancient castle, a dark uneven structure silhouetted clearly against the silver moonlit sea. The trees which surround the palace are almost the only trees to be seen for some considerable distance. There are many delightful spots in the garden, which is so sheltered that sun-bathing could be carried out effectively almost all the year round.

Fishing is extremely good, and when the yacht is anchored near, Marconi and his wife do a good deal of fishing; it is a sport which they both enjoy. "Fishing," says Marconi, "gives you time to think."

Life in any of Marconi's homes is lived perfectly normally; it is not an "Edison" kind of household; meals are served to time and everything goes on as it should in such a household. Marconi does not believe in working during unearthly hours, and does not burn the midnight oil, unless he happens to be engaged upon some extremely important experiment on the yacht.

He believes in plenty of sleep and he thinks that if you come to a difficult experiment or point which requires a careful decision, it is well to sleep upon it.

Life on the *Elettra* for the inventor and his wife and daughter can be well imagined from the description of the yacht, which has already been given. In 1927, the year of his marriage, Marconi had the yacht redecorated throughout, and when "Elettra" was still a baby the Marchesa designed the little cabin which is kept specially for her; it is next to

her parent's private apartments, which are situated amidships. There is a good library on board the yacht, situated not far from the famous laboratory, in which no one is allowed but the inventor, his wife, chosen assistants and occasionally some honoured guest.

Il Duce has visited the yacht on several occasions and has been permitted to see this maze of instruments and apparatus, all so compact, though, compared with those wire entanglements of earlier days.

Naturally, an important feature on the yacht to-day is the finest wireless set obtainable, by means of which the inventor can hear programmes from every station in the world, and Marconi makes a point of listening to news. He has not much time for lighter programmes, experiments keep him too busy. Visitors to the yacht are, of course, charmed with the wireless programmes. Everything on the yacht runs on oiled wheels, the crew of about thirty are all most efficient and devoted to their Chief.

During the last four years, since 1931, Marconi's visits to England have been fairly frequent. The duration of these visits is generally about three weeks, and every moment of each day is occupied.

All through his life Marconi has done a tremendous amount of travelling, in fact, there has not been one year since that eventful journey to London in 1896 that Marconi has not visited some country outside Italy. But without exception all these voyages have been made in connection with some work or mission connected with his experiments. Morocco, Tripoli, Tunis—he spent a good deal of time in those places, but on behalf of his Government, not for pleasure.

More often than not his visits to various places have to be curtailed or lengthened to suit business affairs, not because he desired it. Just before Christmas, 1932, he was in London, and was most anxious to get back in plenty of time to spend Christmas with his small daughter; he succeeded in doing so, but only just in time. Business kept him in London until just two days before 25th December.

However, in 1933, he determined that he would take a

world cruise, upon which he would have time to look round and see for himself the result of some of his work.

Early in 1933, there was a very sad day for Marconi. On 2nd January, J. S. Kemp passed away at the age of seventy-six, in Southampton, where he had been living for a while in partial retirement, though keeping in touch with Marconi and his work up to the very last.

Thus ended a remarkable association and deep friendship of thirty-seven years standing, which commenced when Marconi was fixing up the wire on the roof, as described earlier, for the General Post Office. Marconi never forgets any of those men who have helped him in his work—and their loyalty to him has become a tradition. It is always a tremendous grief to Marconi when any of these men die, but he seldom speaks of Kemp without emotion.

Whatever Marconi told Kemp, he believed implicitly. "I think that whatever I had asked Kemp to do, he would have attempted it, however impossible a task it appeared to be," he has said.

From the days of those early journeys across the Atlantic when Kemp saw that whisky was provided in order to combat the Newfoundland fogs, he made it his especial duty to look after the inventor's physical well-being. In fact, there were times when Marconi, careless as most young men of such matters, wished that Kemp would not worry quite so much about him.

On one occasion Marconi developed a sudden chill when they were at sea and a good many hundreds of miles from a hospital, or qualified attention. The inventor attempted to make light of his illness, but Kemp recognized that it was a severe attack and might take a serious turn if matters were not properly handled, so for a time the assistant became the master and Marconi had to do as he was told, and with most successful results. Kemp never forgot that occasion and many years afterwards he described it all fully to the Marchesa Marconi, who also learned to share her husband's attachment for his faithful assistant. To her, Kemp would never tire of telling stories about Marconi, but he always completed the tale by referring to that illness and saying, "I was his nurse, Madame, I was, and how I had

to look after him—he was not a good patient." And the old man would shake his head thoughtfully.

Everyone associated with Marconi recalls Kemp by his voice; his stentorian tones could be heard almost anywhere at any distance. In appearance he looked a typical sea-faring man with ruddy complexion, and closely-cropped grizzled hair and heavy moustache. Thirty years after the historic signal across the Atlantic, there was a reunion at Marconi House of those who had accompanied Marconi on that occasion, chief among them of course, Kemp and P. W. Paget, and of course Kemp was photographed, as he liked to be, upon every possible occasion, with the first wireless installation.

J. S. Kemp is, however, not the only one of the original members of the Marconi staff who have passed away since the memorable events which marked the opening of the present century. W. W. Bradfield, who afterwards became General Manager and Director of the Marconi Wireless Telegraph Company Ltd., and the Marconi Marine Communication Company, died in March, 1925. "He did a great deal of very valuable work for me," said Marconi, when speaking of Mr. Bradfield in the many experiments in which he assisted.

Mr. Bullock left the Marconi Company in order to take up other work, but after a period of failing health, he too died. His name may be forgotten by the public but not by Marconi, with whom he worked during the cross-Channel experiments.

Dr. Erskine Murray, who was a member of the Marconi technical staff in 1900, when it only numbered seventeen, and who later became a well known writer on wireless matters, died during the War.

Mr. C. S. Franklin, another member of that little band, became famous because of his contributions to research, particularly in connection with beam wireless, and short-wave experiments.

Other names among those pioneers were: Dr. W. H. Eccles, F.R.S., who became President of the Institution of Electrical Engineers, Mr. Andrew Gray, who was afterwards chief engineer of the Marconi Company, and continued to

work for the Company for many years, and Mr. C. E. Rickard, who is still a "Marconi" man.

All these men have played their part in the development of wireless—in some cases a very important part, in several cases they are still doing research and may accomplish further achievements.

CHAPTER XVII

MARCONI'S WORLD TOUR

IN September, 1933, Marconi set off on a world tour, accompanied by his wife and his secretary, Signor di Marco. At the time of their departure, it had not been decided upon what date they would return, but eventually, they arrived in Italy the following January, 1934. What happened during that tour would in itself fill a book, for not only were the most interesting places visited, but many remarkable people were encountered.

Marconi had several objects in view when he embarked on this trip. During the past years, he had received a number of requests from various parts of the world, that he would visit this or that college or institution, or inspect a certain wireless station. Apparently, when these suggestions were received they were put aside and not very seriously considered, though of course, polite explanations of Marconi's inability to accept them were always forthcoming.

However, for a good many years there had been deeply rooted in Marconi's mind a determination that at the first opportunity he would make an extensive tour, in which he could see for himself many of the wonders which had been accomplished as the result of his invention, especially in distant countries and in spheres far removed from those with which he is most intimately concerned.

His wife also was extremely anxious to see the result of her husband's work; she is tremendously proud of his achievements, and takes a lively interest, not only in what wireless has already done, but what it may do in the future. She has studied the subject closely and knows a great deal about it.

Then, Marconi's medical advisers had suggested to him that a rest from his experimental work would be good for him, and a period of complete relaxation would restore a nervous system which is, to say the least of it, highly strung.

What a contrast between this voyage across the Atlantic and the one which had taken place more than thirty years earlier, when he travelled to Newfoundland to receive those first signals, which he was so determined would cross all right, but about which everyone else had their doubts. In those days, Marconi was a man with a great conviction of the future success of his experiments, but in 1933 he set forth over the same ocean, a man whom the whole world had acclaimed as the greatest inventor of his age.

It was during a stay in London, six months after the tour, that he described his tour in detail, making the whole into a complete story, all the more interesting because it had been impossible to glean anything complete from the hotch-potch of Press reports which were circulated from all parts of the world during the tour. Although there was one aspect of news very apparent: every country he visited was delighted to see the inventor whose discoveries had wrought such a change in their lives.

Afterwards Marconi expressed himself delighted with the trip. What had pleased him the most was to see the progress which wireless stations had brought about in the Far East, and the tremendous enthusiasm there was for the increased development of wireless in the most unexpected countries. All the superstition which was rife in some countries only a few years ago, seemed to have completely disappeared, and to have been replaced by a demand for more rapid advances.

After leaving Europe, the first destination of the Marchese and Marchesa Marconi was New York, with which city he is of course nearly as familiar with as he is with London.

Before Marconi and his wife actually landed, the Americans began to pay tribute to the "Father of Radio" as they affectionately call him to-day. It was a brilliant sunny morning when the S.S. *Conti di Savoie* sailed into New York Harbour. Radiograms of welcome and messages in reply were flashed between the ship and the shore, some time before the vessel berthed.

Their friend David Sarnoff did not wait for them to land, but went aboard the *Conti di Savoie* to welcome them. Sarnoff, who is of course, President of the Radio Corporation

of America, presented them with an invitation to Chicago, on behalf of Rufus Dawes, President of the Exhibition, "A Century of Progress," which was to be held there.

They were interested visitors to the new National Broadcasting Studios in Radio City, and even Marconi was delighted with it as an example of the most modern and up-to-date installation for broadcasting. They heard programmes being transmitted to the farthest outposts of the States, and the Marchesa Marconi was amused by some of the quaint speeches which accompanied the sponsored programmes and which make American broadcasting so different from those of the B.B.C. in England.

Like every other visitor to New York's broadcasting station, they were impressed with the vastness of the whole affair. It must be remembered that in London, the main programmes, with the exception of tests, finish at midnight, and similar conditions prevail in Italy, but in America they continue all night, because of the size of the country, which means that there are great differences in time between one State and another, and thus there is a need for programmes at widely differing hours.

Many old acquaintances were renewed and David Sarnoff referred more than once to the memorable talk to and from the *Elettra*, which he said had caused quite a stir in America at the time when it took place.

Actually, after their arrival, 28th September, the Marconis only remained two days in New York, but they were days in which every moment was occupied.

The afternoon after their arrival, Marconi met and talked to a number of editors of radio and radio communication papers. What questions they asked him, how, when, why? What about television, micro-waves? This battery of questions did not, however, appear to worry Marconi, who endeavoured to answer them all with a smiling frankness which charmed everyone.

They listened with great attention when he made the forecast that, "the great promise for future development in radio lay in the field of micro-waves, which," he added, "he had been recently experimenting with much success."

Later that night there was a dinner given in his honour

at the Ritz Carlton Hotel, by General James G. Harbord, Chairman of the Board of the Radio Corporation, and Mr. Sarnoff.

On the following afternoon the Marconis left for Chicago, and while they were aboard the train they heard the programme which was being broadcast throughout America. This was a programme which had been specially written to portray the rise of radio. A number of Marconi's most important experiments and episodes in his career were dramatized. Finally the broadcast ended with an announcement that the following week from 2nd to 7th October would be a Radio Progress week.

Festivities in Chicago commenced from the moment they arrived, when there were many cheers at the station. They were met by representatives of the city and some of the organizers of the Progress Week, as well as members of the Italian Government, and the American Legion. The inventor and his wife were received by Cardinal Mundelein after they had attended Mass. This reception was followed by a luncheon given to Marconi by the Italy-America Society.

In the afternoon there was a sail on Lake Michigan, which Marconi found a delightful respite after crowded streets of cheering people and receptions which kept him occupied during every moment of them. In fact, he was extremely sorry to leave the lake and hasten to prepare for the dinner which he attended with his wife, given by the Italians of Chicago to their distinguished countryman.

The fact that more than 1,400 attended gives some idea of the popularity of this event. Every speech in which a tribute was paid to the inventor was loudly applauded. During the evening he had conferred upon him the Honorary Degree of Doctor of Law, by the Loyola University.

It will be recalled that about two years previously, there was a movement afoot to inaugurate a "Marconi" Day, upon which the inventor could be especially honoured and radio programmes and greetings specially broadcast. At first, it was thought that the most suitable day for this would be the anniversary of his birth in April, but later it was decided that 2nd October should be the day set aside.

The first event then of Marconi Day, 1933, in Chicago was when Marconi was escorted to the Stadium at 10.30 a.m. to attend the official opening of the American Legion Convention. Here he spoke briefly to his audience on behalf of the Italian Government.

The luncheon that day was a particularly interesting one; it was held at the Rosenwald Museum of Science and Industry, and there were prominent scientists from all over the States present, the majority of whom made most interesting speeches, and there were some remarkable suggestions as to the kind of things which might be accomplished later by means of radio. After the luncheon there was an inspection of the Museum's scientific collection.

Now took place one of the most outstanding events of Marconi's tour, his visit to the Chicago World Exhibition.

They first arrived at the Exhibition at half-past four, by motor-car from the Rosenwald Museum. They were received by the principal officials of the Exhibition and a guard of honour was formed to escort them to the Hall of Science, a fine imposing hall, which had been gaily decorated with the Italian colours in honour of Marconi's visit.

It was in the great court of the Hall of Science that a ceremony of tribute to Marconi began at 5.30. First of all there were greetings from Rufus Dawes, and Dr. Arthur Compton, the well-known physicist, made an address in recognition of all Marconi's achievements in the field of science. Then Judge John W. Van Allen, who represented the Radio Manufacturers Association, presented a testimonial to the Father of Radio.

It was impossible for Marconi not to feel deeply moved by such tributes, coming as they did from all kinds of people, scientists and business men, in fact, as one of the speakers had said, from the entire American nation.

The climax of the proceedings and possibly the most important moment from a scientific point of view, was yet to come. This was when the lights of the Fair were turned on by a radio impulse, started in Italy by beams from the star "Capella," picked up by a telescope in the Florence Observatory, and the letter "S" used in Marconi's first transatlantic experiment was sent round the world.

It is estimated that the beam of light from the star Capella must have started on its journey to earth in the days of Galileo and this was an experiment made symbolically to link up the work of the two great Italians, Galileo and Marconi.

The oldest telescope in the world, made in 1609, was used to collect the starlight, which was transformed from light power to electricity, in order that it would be able to switch on the lights of the Exhibition, 5,000 miles away.

After the beam of starlight had been collected it was converted by photo-electric cell, the eye-piece of the telescope having been removed so that the starlight could pass through the telescope and penetrate the holes of a revolving cardboard disc which was worked by a small motor. The electric waves thus sent from the Arcetri Observatory (near Florence) were amplified by the Florence Radio Station and relayed to Rome. From there they were in turn relayed to the Paato Smeraldo short-wave station and finally transmitted to the Chicago Amplifier. The United States Navy joined in the celebration of "Marconi Day" in America on 3rd October, when Mr. Claude A. Swanson, Secretary of the Navy, sent the following message to Marchese Marconi at Chicago's Century of Progress Exhibition:

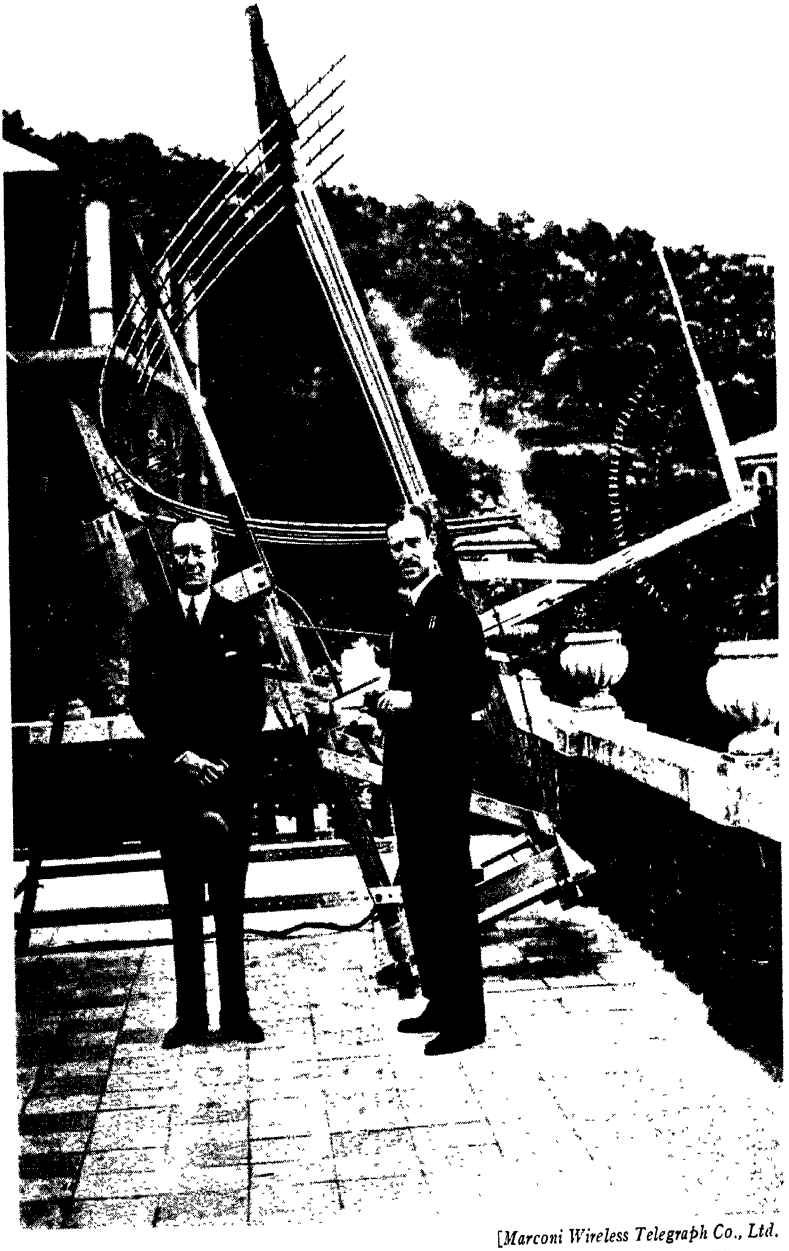
"On behalf of the United States Navy I congratulate you on this occasion commemorating your great achievement in giving radio to the world. The Navy was quick to visualize the tremendous influence of radio communication that was bound to follow your invention, and in the very beginning set about to put it to practical use.

"Radio communication has added greatly to the happiness and safety of those that travel by air and go down to the sea in ships.

"Our debt to you is heavy and it gives me pleasure publicly to acknowledge it.

"I hope Marchesa Marconi and yourself enjoy your visit to our country. May you have many years of happiness and continuance in your valuable service to mankind."

The reception in the Court of the Hall of Science and all the other events of importance connected with Marconi's visit to Chicago were broadcast by the National Broadcasting



[*Marconi Wireless Telegraph Co., Ltd.*

MARCONI WITH HIS LATEST MICRO-WAVE APPARATUS

Company, some of them being sent on by short wave to Italy.

There was a presentation of another degree at the North Western Universtiy. Marconi was a guest at a dinner given by the American Legion and a reception was also given to him in the Italian Pavilion at the Fair.

They returned to New York by way of Niagara, as the Marchesa Marconi was anxious to see the Falls; she was not disappointed in them either; as on many other occasions during their tour, they were very lucky in their choice of weather, and saw Niagara under excellent conditions.

On Monday, 9th October, Marconi visited the Central Radio Office at New York City, and the radio stations and laboratories at the R.C.A. Communications Incorporated, at Rocky Point, Long Island. David Sarnoff accompanied him, and Marconi was much interested as Sarnoff pointed out all the latest improvements and various devices which had been introduced for the good of broadcasting. Among other people who accompanied them were W. A. Winterbottom, Vice-President and General Manager of R.C.A. Communications, C. H. Taylor, Vice-President in charge of engineering, and other officers in the communications company, and G. Matthieu, Marconi's assistant.

At the Central Offices of the R.C.A. Communications, which Marconi visited before 10 a.m., he inspected the Company's facilities for transmission and reception of facsimile pictures by radio, also the methods they had of handling international broadcast programmes, to and from the various American studios, which form such a huge network. He was also shown the direct radio-telegraph circuits which radiate from New York to more than thirty countries throughout the world. (This number has been increased since Marconi's visit.)

Usually the radio-telegraph signals are received silently on tapes, but on the occasion of Marconi's visit it was decided that something rather more sensational should be done. The signals from the Marconi short-wave beam station in England were connected to a loud speaker so that the visitor might hear what was taking place.

This British station was one of the short-wave

installations designed by Marconi for regular commercial service. The American and British ends of the circuits have been in use since about 1927.

When Marconi arrived at Rocky Point, Long Island, many old memories were revived. He thought of the early stations on Signal Hill, at Cape Cod, and elsewhere, when he looked at the small whitewashed shack—only about 8 feet square, which stood gleaming in the sunshine, not only a landmark, but a milestone in the history of radio. It was the original building, used by Marconi for his first commercial radio-telegraph station in America, and its subsequent history was an interesting one. It had been erected in the first place at Babylon, Long Island, in 1900. After having been in frequent use for some years it was abandoned and practically forgotten, until it was rediscovered by Major E. H. Armstrong. He was a great admirer of Marconi's work, and a radio inventor himself; he felt that the old shack should not be entirely forgotten, so he had it removed to Rocky Point.

Marconi himself was quite surprised as well as pleased to see the old building again.

His reverie was cut short, however, by a suggestion from David Sarnoff that lunch would be ready in a few moments. After this repast had finished Marconi inspected all the many buildings at the station, and saw the huge, powerful radio transmitters, controlled from the central office in New York. It was while he was looking around these buildings that Marconi had the opportunity of renewing his acquaintance with some of the engineers of the Corporation, whom he had met on several previous occasions. Among them Mils Lindenblad, H. H. Beverage, B. S. Y. Clifton, H. O. Peterson, C. W. Hansell and Philip Carter.

Marconi was particularly interested to find a number of recent improvements had been installed, among them multiple wave-length, directive antennæ; this type of radiator differs considerably from the Marconi reflector type, and the R.C.A. long-line control apparatus for applications to ultra short-wave work. This so-called long-line control is a contribution to making the ultra short waves commercially useful, in that this apparatus keeps an ultra short-wave transmitter from straying or "drifting" from a definite

operating frequency. It replaces the crystal control method of accomplishing the same result which is now in general use in radio-telegraph and broadcasting stations throughout the world. The advantage is said to lie in eliminating a vast amount of frequency doubling equipment, which in the case of an ultra short-wave station may be cumbersome and complicated as to cost more than the power producing section of the transmitter. By comparison, the engineers pointed out, long-line control is an extremely simple apparatus.

The American engineers also told him that they found one of the biggest problems in generating the micro-waves was to make the vacuum tubes deliver more power when they were oscillating at the terrifically rapid frequencies necessary to create radio waves which were only a few centimetres in length.

American engineers at that time, Marconi was told, were examining every possibility of using high voltage as a means of forcing more power through the tubes to the small antennæ. The production of higher power of ultra short waves, it was generally considered, would hasten the day when still more new secrets of radio science would be discovered.

Any ordinary man would have seen so much in that one day that he would have been too fatigued to concentrate on further scientific sight-seeing for a while, but not so Marconi. The following day, again accompanied by David Sarnoff, he visited the Camden plant of the R.C.A. Victor Company, and was quite enthusiastic about the amount of radio research he saw being carried on there.

Later that same afternoon he joined the Marchesa Marconi and they both left by train for Washington. Here one of the first things the Marchese and Marchesa did was to lunch at the White House with President and Mrs. Roosevelt. This lunch was, as they had hoped, a quiet, informal family affair. The President had a good deal to say about wireless and remarked that it would be difficult to imagine the world to-day without it, both as a means of communication and entertainment.

Marconi recalled earlier days at the White House, when he was a frequent guest of another President Roosevelt—

Theodore—who had always been so understanding about all his hopes and wireless activities. Mrs. Roosevelt, during the course of the luncheon, talked a great deal about the social work in which she was interested; she was anxious to know about education and public welfare in Italy, and asked both the inventor and his wife a number of leading questions. The Marchesa Marconi has described Mrs. Roosevelt as having an almost unbelievably vast knowledge of social welfare affairs. However, as a result of this luncheon, Mrs. Roosevelt presented Marconi with a number of books on sociology, and containing many of her speeches, which he prizes very much and are now in his library in Rome.

Another festivity in Washington was a dinner by the Italian Ambassador, Signor Russo. Tea the next day was taken with Secretary and Mrs. Hull. The reception given by Frank Wozencraft, Assistant General Attorney of the Radio Corporation of America, was quite an informal one, when the chief topic of conversation was what they were destined to see on their trip to the Pacific coast.

After leaving Washington, Marconi and his wife set off for a tour of the Pacific coast. At South Bend, Indiana, which was one of the places they stopped at, Marconi had conferred on him the honorary degree of Doctor of Law of the University of Notre Dame.

Marconi and his suite travelled in a private car through America, and it was the Marchesa Marconi's first experience of long journeys on the American railroads. An entirely new experience for both of them was the Grand Canyon of Colorado, which impressed them tremendously with its beauty, for they arrived there in time to see a glorious sunset, when the wild country appeared to be aflame with golden orange light.

It was here that Marconi, who is used to ovations of all kinds, experienced a most unusual one.

They were staying at an hotel in the district for a few hours, and feeling tired after their journey, had gone to their room to rest and change from their travelling attire. During their absence a number of local cowboys had been listening to the radio, which was broadcasting the news in the large hall, just as they were accustomed to do every day; by some

means or other the news got round that the inventor of wireless was staying in the hotel. At first some of the men were incredulous and suggested that it was "too tall a story" to be believed. However, when they had inquired from the management, and were assured that their suspicions were correct, they sent the news out to their neighbouring friends, who in turn informed others.

The result was that when Marconi came downstairs, he found the place literally crowded with cowboys, of all types—fierce-looking fellows, who looked as if they might have a streak of Indian blood, others who could only be called "tough guys" if appearance is anything to go by, and a great number of them, frank, jolly-looking fellows. Sombrero hats, sheepskin breeches, the air heavy with tobacco, the scene appeared to Marconi to look more like a Wild West film than anything else.

As soon as they saw him they commenced to cheer and all wanted to shake hands with him at once; in fact, Marconi admitted that his hand ached a good deal when they had all finished with it. The cowboy's grip is no legend, he says.

In the course of a few minutes they must have asked him hundreds of questions, about radio, about himself, all of which he answered to the best of his ability, which was not altogether an easy task, with everyone talking at the same time.

They told him all about their own radio sets and the various experiences they had with them and how much the programmes meant to them. Previously, they had often felt homesick, and cut right off from civilization, but this was true no longer—radio had changed all that, they could even give their own local "hops," as they called their dances, to the strains of some of America's most famous dance bands. Most of all they appreciated news from the outside world; there were older men who remembered when a traveller bringing news from the big cities which was weeks old was welcomed, now—well, they just knew what the old world was doing as soon as New York did.

Marconi appreciated this unconventional reception as much as the best organized affair, because it was sincere; here were men to whom wireless had really been a great gift: it had saved them from isolation.

Although it was now late October, the heat when they were travelling through the Arizona desert and New Mexico was intense and it was not with regret that they reached California.

During their Hollywood visit everything was done in true Hollywood style. Not only did they meet all the principal stars but their hotel was fully equipped with a wireless station from which broadcasts could be sent out as well as programmes received. Marconi was much interested in this installation, which he found well equipped and up-to-date.

In order to give him full Hollywood honours and hospitality, two hundred film stars gave a luncheon for the Marconi party, the finest menu was prepared and some marvellous gowns were worn by the women, who all gazed with the greatest admiration at the lovely Marchesa Marconi, whose golden hair and blue eyes were not entirely what they had expected to see in an Italian lady.

As an inventor, of course, Marconi was very anxious to see the studios throughout; it was not the sets or the scenic effects which interested him so much as the various types of talkie apparatus, and the latest methods of reproducing the sound. He also inquired if steps had been taken concerning television. One night they were guests at the famous Chinese Theatre, and it is true that not even the "Garbo" herself created such a sensation as Marconi did when he made a short speech to his hosts and hostesses, and told them how much he had enjoyed all that he had seen in Hollywood. "I hope it will not be my last visit to you," he said. He told them, too, that both in England and Italy he visited the cinema from time to time, and now his enjoyment would be increased when again he saw some of the stars who were listening to him to-night.

The Marchesa Marconi had an amusing adventure in Hollywood when she received a serious offer to go on the films, in consideration of a sum running into some thousands of pounds, for quite a short period of work. Very hard they tried to persuade her to have even a test, but she smilingly answered "No," and was actually quite determined about it.

Los Angeles—and from there on to San Francisco. An

original supper-party took place at Mount Wilson Observatory, in the company of more (celestial) stars than those which had entertained them in Hollywood. "It was a lovely fine night," the Marchesa said later, "and we had the most marvellous glimpse of the heavens, and of a star which I cannot remember the name now, but was of note at the time, because it is so rarely seen."

There was great excitement at San Francisco, partly perhaps because Mayor Rossi is of Italian extraction, his father having gone out to America in the Klondyke gold-rush days. In Marconi's own words: "He did everything humanly possible to make our visit a happy one, and we did enjoy ourselves." An Honorary Citizenship was bestowed on Marconi before he left San Francisco; he was pleased, because the city had memories for him, although he had never been there before. He saw the room in the radio station from which the first message across the Pacific was transmitted. One of the events which the Marchesa enjoyed was her drive through the famous Red Wood Forest, with its 6,000-year-old trees.

From San Francisco they passed on to Honolulu, where they were received by the Governor—General Judd. No triumphant General marching past the scene of his conquests can ever have seen more evidences of his success than Marconi, and they can never have been so widespread—for the landmarks of wireless encircle the globe. For instance, at Honolulu, when Marconi was admiring the splendid installation, he was reminded of the fact that it had been originally one of the earliest wireless stations erected—about 1905. He referred to this when he broadcast from there and held a conversation with his previous host, Mayor Rossi, in San Francisco.

During the few hours which he spent on the island, the entire place was *en fête*, and a suitable but noisy acknowledgment of his presence was when practically every inhabitant turned on their radio. After Marconi had broadcast at Honolulu, he listened-in for some time to innumerable messages which were being sent from ships at sea by wireless.

After his trip, Marconi said that he found it very difficult to say which country he had found most interesting

or where he had enjoyed himself the most. "I was particularly struck everywhere," he said, "by the splendid manner in which wireless and broadcasting stations were run and I was agreeably surprised to find a number of Marconi-trained men in all parts of the world."

Japan, however, must have furnished some of the most unusual sights and entertainments encountered on the trip.

At Kyoto there is an enormous broadcasting and wireless station, and from there Marconi said there are programmes broadcast throughout the day and late at night.

In addition to the general Japanese programmes, which consist of news, music, and entertainment, as in the West, there are programmes broadcast in English, some of which are very similar to those broadcast from the London studio.

It gives a good deal of insight into Marconi's character to find how he has observed all these minor details, as well as the more important and obvious facts.

It had been arranged that both Marconi and his wife should broadcast in Japan, and on a fine autumn morning they were driven by car to the Deer Park in Naira, where microphones had been fixed up; an English announcer accompanied them and announced their speeches both in English and Japanese. "A broadcast could not have been arranged in more charming surroundings," said Marconi describing the event afterwards.

At Yokohama and Tokyo there were large stations to be inspected, and in them Marconi found all the very latest equipment. As in the other countries he visited, hospitality was proffered everywhere, and in Tokyo there was a big dinner given one evening by the Maple Club, at which all the European residents were present, including, of course, the Italian Ambassador to Japan.

A more unusual dinner, however, was a real Japanese one given by some of the most important people in Japan. This repast lasted for two and a-half hours, and all the guests were seated on cushions on the floor in orthodox Japanese fashion. "The cushions were large and comfortable, so the feat of sitting on the floor for such a long time was not as difficult as it sounds," said Marconi. All the food was of

the kind which pleases the Japanese epicure, from bird's-nest soup to a delectable concoction of the famous shark's fins, finishing, of course, with the final cup of *sake*, without which no Japanese meal of importance could be complete. This was drunk with the utmost ceremonial in honour of the guests.

All during the dinner a delightful entertainment was taking place. Obviously it was impossible to continue eating during the whole of two and a-half hours, so there were long interludes between the various courses.

A troup of geisha girls performed intricate national dances, to their own special music, played on instruments unknown in a Western orchestra; these national dances, however, were interspersed here and there by specially acquired dances with a Western flavour, which they doubtless believed would give pleasure to their Western guests.

To quote the Marchesa Marconi: "It was a wonderful performance. The girls were all so young and pretty, with their tiny flower-like painted faces and exquisitely-coloured kimonos, and they smiled most charmingly and shyly when they knew they had pleased us."

Remarkable meals seem to have been the order of the day during the Japanese visit, for another not less original repast was provided when the inventor and his wife were the guests of Mr. Mikamoto, the Japanese who discovered the way to produce cultured pearls, and who has, of course, revolutionized the pearl trade.

Oysters from his own fisheries were served for several courses prepared or cooked in an entirely different manner each time. Marconi was just sampling a crisply-fried oyster, when his wife noticed that he made a slight grimace; after a moment he carefully contrived to remove a pearl from between his teeth; only a few moments later his wife had a similar experience. This, in fact, is one of the ways in which Mr. Mikamoto likes to honour his guests. Be that as it may, Marconi has had a stud made out of his find. An inspection of the pearl fisheries followed, when they saw the girls diving to fetch up the shells from the specially constructed beds.

As everyone knows, the desire of every Japanese is to

see Fujiyama, "The Sublime Fujiyama," as Gonoske Komai, the poet, has called it many times. But Fujiyama's snow-capped summit is more often than not shrouded in mist, so that many who visit the lovely surrounding valleys and near-by lake, have to go away disappointed because the mists have not allowed them to see the mountain, which every Japanese looks upon as sacred.

Marconi, like every other visitor to Japan, was anxious to see the mountain, but as there was a slight mist when they set out by car, neither he nor the Marchesa were very hopeful about it. Their Japanese hosts took them through grand scenery, and despite the fact that October had given place to mid-November, the weather was still excellent, with a gentle breeze and crispness in the air which had a most enlivening effect.

The Marchesa Marconi was poetical in her description of the maple-trees, which glowed in every shade between deepest red and a pale yellow-green. Their glorious colouring was shown up in strong relief by the dark Japanese pines which grew higher up the hilly slopes which rose from the road along which they travelled. Now and then a bend in the road would be followed by a greater feast to the eye, for chrysanthemums were still in bloom, strong, shrub-like kinds, but such a galaxy of colour that it would be impossible to describe.

At last the slopes of the mountain could be seen through the soft misty blue-grey of the pine trees, this symphony of colour only broken by the distinct ruddiness of their slender trunks.

The snow-capped head was hidden, as they had expected, in a soft mist which, however, they could see was growing more silvery as the sun struggled to gain supremacy—then the mist turned almost to gold and seemed to move away quite rapidly in great billowy clouds, the clouds of a Japanese print. The sun shone—and Fujiyama could be seen entirely, clear-cut and like nothing else on earth.

There was great rejoicing among the Japanese members of the party, and they told Marconi that he must be specially lucky, for when Fujiyama shows her summit in a burst of sunshine, as they were witnessing at that moment, it is a

sure sign that the gods are pleased. Marconi and his wife were destined to have good luck. So with a clear day and blue skies ahead they completed what had been a beautiful and unique drive.

Whilst in Tokyo, Marconi was received in audience by Prince Chichibu, brother of the Emperor, who could not receive Marconi because the Court was in mourning.

The Emperor, as most people are aware, is an extremely intelligent young man, who allies a keen knowledge of science and interest in modern affairs with a respect and reverence for the older traditions of his country. He has always taken a lively interest in the development of wireless and personally inspects improvements which have been made from time to time in the Japanese stations. Like most distinguished visitors, Marconi was received in the Royal Palace in a room which is really a large wooden pavilion with a gloriously carved roof set with rare enamels.

Marconi was presented on behalf of the Emperor with the ornate paraphernalia which belongs to the Order of the Rising Sun. The Grand Cordon of the Order of the Rising Sun had up to then been reserved exclusively for Japanese Princes and Ambassadors holding highly ranked positions in the diplomatic world.

Both Marconi and his wife had seen Prince and Princess Chichibu on a former occasion.

If they were loth to leave Japan, it was not because they were not anxious to visit China, but here again the interest was of a different kind. The wireless station at Shanghai is a truly enormous one, and is in every way so up to date and modern that it might easily be Chelmsford or Coltano.

Once more Marconi heard broadcasts coming from America and other far-distant spots; then the next station he visited was perhaps the most interesting experience of all, purely from the point of view of novelty. The new station at Mukden, Manchukuo, is certainly the largest broadcasting station in the Far East.

"There is every modern device installed there," Marconi said in describing it, "and it should play an important part in the future development of communication in that extensive land. It is a fine modern building of concrete," he added.

A dinner was given in his honour over which Mr. Tsing-Hsien-hsin, Minister of Communications, presided. Among the guests were Manchukuo officials, members of the Foreign and Japanese Chambers of Commerce, Mr. S. M. Myers, American Consul, and all the Consular body.

By this time the weather was becoming much colder and the Marchesa Marconi found that a fur coat was not too warm for everyday wear. They travelled to Pekin via Darien and the entire journey was full of interest. Marconi said it was very obvious that wireless was the best and most reliable means of communication in the country.

It was early in December when they visited the New International Radio Station at Chengu, where Marconi was much interested in the conversations which he had with the Chinese engineers, who had learned most of their wireless knowledge from Marconi men in China. The Marconi party was shown round by Dr. Yen Jen Kwang, Director of Radio Administration and Communications, and Mr. W. J. Richards, head of the Marconi Company in Shanghai.

Six days were spent in Shanghai, during which they did a good deal of sight-seeing and were entertained at a number of social functions, among the latter a cocktail-party given by Mr. Richards at the Cathay Hotel and a banquet as Astor House, which was also in honour of Commander R. Boscarelli, the new Italian Minister who had just arrived in China.

When Marconi first set out upon his world tour, he had intended visiting India and had thought that it might be possible to go as far as the Himalayas, but this was found to be impracticable; he had been away a long time, and there was business to be attended to both in London and Italy. However, a call was made at Colombo and at Bombay which, of course, possesses the finest wireless station in India, and so ended a trip which was not only vastly entertaining, but which gave Marconi a greater insight than even he had already possessed into the wonderful revolution which wireless has wrought throughout the world.

CHAPTER XVIII

MARCONI'S WIFE AND DAUGHTER—CONCLUDING YEARS

MARCONI'S return to Italy meant the return to heavy arrears of work, for however many people Marconi may employ, there is so much of his work which can only be done personally. Besides, everyone who knows Marconi is aware how particular he is about attending to small details himself; in fact those who work under him are sometimes distressed because their Chief will not leave more for others to do, and thus save himself. This quality has undoubtedly been one of those which helped Marconi to success, for never have any of his experiments failed through want of care or attention to detail.

He has an excellent memory and declares he never loses anything. Again in the matters of papers and records he has his own ideas. It annoys him if these are not available for reference just when he needs them. In consequence when he travels he takes several cases of private papers with him. A remark that something cannot be found generally brings a smile to his face. "I can find it," is his usual quiet reply.

His memory for dates and the smallest details connected with events which happened years previously is most remarkable. In revising the proofs of this book, for example, he showed an astonishing memory for words and dates. He remembered exactly what he had said or someone else said to him in 1900, 1902, or whatever the date might be.

It is because of his good memory and methodical method of working that he is able to get through an enormous amount of business without any appearance of rush or bother.

The one touch of sadness connected with their tour, if it can correctly be described as such, was their separation from their baby daughter, Elettra, who had remained in Rome under the careful eye of her grandmother, the Countess Bezzi Scali.

To the tiny girl, four months' absence seemed a long

time. There was great joy in the old house in the Via Condotti when, one day, her grandmother told her that her father and mother were going to talk to her.

At first she opened her big blue eyes in puzzled surprise, but she soon understood and was listening intently to her father's voice on the telephone, as he spoke (by means of wireless telephony from the liner on which they were homeward bound). A few moments later the Marchesa was telling her little daughter she would soon be with her again and that she was bringing her some lovely gifts.

However, when they actually returned to Rome, she was overcome with joy, and afterwards was greatly excited about all the presents which had been presented to her parents, on her behalf, in many of the countries they had visited.

Elettra Marconi's nursery at their Via Condotti home is really like a toy-shop, for every Christmas and birthday, toys are sent to her by friends of her mother and father from all over the world. Although, like most small girls, she is very fond of dolls, she prefers animals, and treats a woolly lamb or doll exactly as if it were a real one. She inherits, already, her father's gift for doing everything thoroughly, and even if it is only a stuffed dog which has to be taken for a walk, she takes the matter most seriously.

Though only five years old, she enjoys doing quite difficult puzzles, and does not like to be interrupted when she is busy with them. With a characteristic wave of her small hand she dismisses any disturbances and concentrates upon the matter in hand, just as her father does. Marconi encourages the power of concentration in his daughter. Elettra also inherits her father's love of the sea and is quite as much at home on the yacht as her parents are. To her mother she speaks usually in Italian, to her father both Italian and English, and although she does not yet speak English fluently, she pronounces the words without any trace of foreign accent. Marconi, of course, is a fine linguist, and the Marchesa speaks French as easily as her mother tongue, and her English is equally good, though spoken with a slightly broken accent, which it is to be hoped she will never lose because it is so charming.

Marconi is devoted to his little daughter and there is always a portrait of her on the desk where he is working, and whenever possible she accompanies her parents to England.

Marconi's first visit to England after his tour was in the summer of 1934, when, however, he did not make a very lengthy stay, as he was anxious to return to his yacht, where he was busy making further experiments with micro-waves. A transmitting station had been installed at the Hotel Miramare at Santa Margherita Ligure, whilst the yacht was lying off the Tirreno coast.

The Marchesa Marconi has something to say about these experiments, which surely show that she is a model wife for a genius.

"Every day," she said, "there would be some new phase in my husband's experiments; sometimes they would be disappointing, another day they would be successful beyond his hopes, and that is where I think that a wife can be so much assistance to her husband; she can encourage him when he is a little disappointed and assure him that things will turn out better the next day—then when he is successful she can share his joy. A wife can understand and take an interest in all her husband's work, without really knowing everything about it, which would, of course, be impossible in a case like my husband's."

Undoubtedly one of the reasons for Marconi's ability to concentrate so keenly on his experiments to-day, as if he were still a young man, is because his wife saves him from all unnecessary trouble. Whenever possible she will deal tactfully with people who want to see him or bother him about matters which are of no moment. It is she who endeavours to keep their home life apart from business worries, for she firmly believes that it is in his home a man should find rest and relaxation. Unless they have social engagements, Marconi dines and lunches at home, and office appointments are planned to make this possible.

Yachting is not the only taste they have in common; they are both keen opera-goers and music-lovers, though it is not surprising to find that at home in Rome Marconi frequently listens-in to a concert, instead of going to the

concert hall. This with a wireless set which leaves nothing to be desired.

The Marchesa Marconi is an ideal hostess, not only to her own personal friends but when fulfilling those many social duties which her position as the wife of a great man demands. When in Rome, there is seldom a week passes when some "business" acquaintance has to be entertained. Some women might find this irksome, but she never does because she takes such a wide interest in both affairs and people. Half the secret of her charm is that everything interests her.

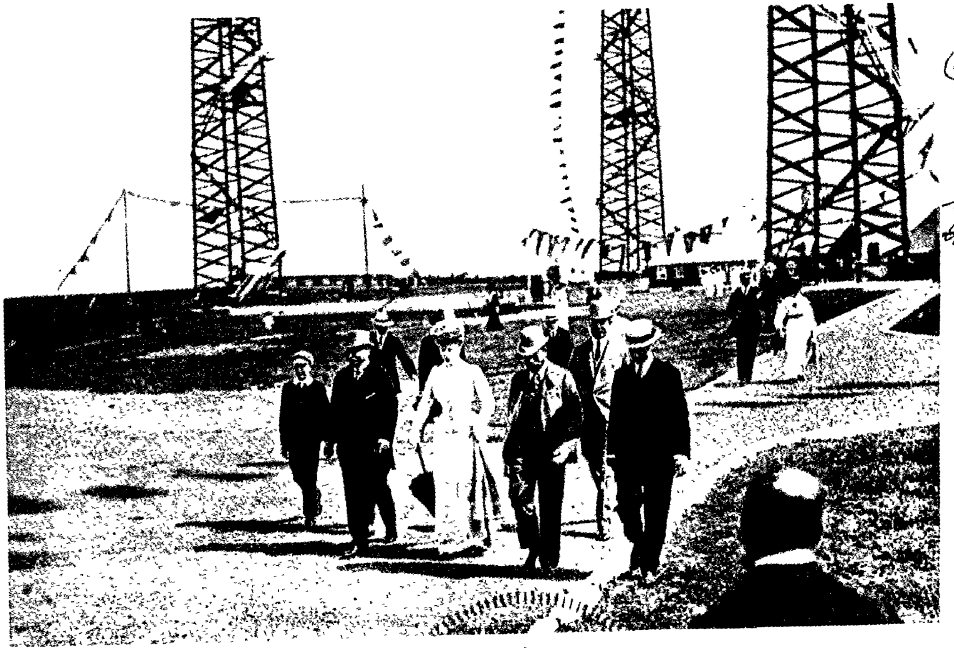
She is very often glad when a few days' respite from the social round is possible and that is why she, like her husband, enjoys life on the *Elettra*. There, when he leaves his laboratory, a quiet hour can be enjoyed strolling up and down the deck, just enjoying a quiet talk. Marconi is not a bridge or card player, and for leisure prefers reading; they both enjoy historical romances.

In November, 1934, Marconi arrived in London for another of his hurried business visits, and as there was a great deal of business awaiting him, he could be seen leaving his hotel in Piccadilly by 10 o'clock each morning. Despite the fact that he insisted that he felt quite well, many of his English friends thought that he was looking very overtired. As a matter of fact he had not entirely recovered from the effects of gastric influenza (he had had a severe attack about two months previously, when engaged upon experimental work off the coast of Italy).

In addition to the business calls which his London visit was making upon him, he filled a number of social engagements; he is always besieged by friends who want their friends to meet him, public dinners and so on.

Towards the end of November he journeyed up to Scotland, where he was specially honoured, for he was elected Lord Rector of St. Andrews University by a majority of about one hundred votes, though it is doubtful if many of those who voted for him realized that he has a strong strain of Scottish blood.

The result of the poll was announced on a Saturday night, amid great excitement, by the Principal, Sir James



MARCONI STATION MEMORIES. THEIR MAJESTIES (AS PRINCE AND PRINCESS OF WALES) VISITING POLDHU, 18TH JULY, 1903, WITH SIGNATURES OF THE ROYAL PARTY, NOW PRESERVED IN THE MULLION HOTEL

Irvine. Marconi travelled back to London the following Sunday and was hard at work again on Monday.

A little respite of quite a different type was when he and the Marchesa accompanied the Italian Ambassador and Signora Grandi to the Arsenal football ground at Highbury, to see the very exciting Anglo-Italian football match which took place there, and which only resulted in victory for England after a very severe tussle. Neither Marconi nor his wife seemed to mind the London fog which enveloped the ground before the completion of the match, but both said how much they had enjoyed it whilst, of course, regretting their countrymen had not been the victorious team.

Every day he became more tired, and his wife grew more worried about him; then, on 29th November, he and the Marchesa attended the wedding of Prince George (Duke of Kent) and Princess Marina, at Westminster Abbey. It was about two days afterwards that announcements appeared in all the papers that Marconi had gone into a nursing home. His London doctor had told him that a complete rest was absolutely essential and that if he did not relax the consequences would be serious. It can well be imagined that this was not welcome news for a man as active as Marconi, but he is not foolish in regard to his health, and believes in safeguarding it. So doctor's instructions were obeyed.

At first it was stated that this rest would be for about three weeks, but at the end of a fortnight the doctor suggested that the time would be prolonged considerably beyond the period which he had first intended. Meanwhile the Marchesa Marconi remained at the hotel. Although she was able to see her husband for a while almost every day, she felt rather lonely, so arrangements were made for her mother, the Countess Bezzi Scali, to come from Rome and bring with her the little Elettra and her nurse.

At first it was hoped that Marconi would be well enough to leave the Empire Nursing Home before Christmas; it was realized that he would not be able to follow his usual custom of returning to Italy just before the festival. It was owing to this belief that he was asked to broadcast an appeal on behalf of the National Institute for the Blind, from the B.B.C. on Christmas Day.

As it happened, however, he was not able to return to his hotel until early in January, and one of the first relaxations he had was to take his small daughter to the Circus at Olympia, to her intense delight. Marconi himself enjoys a visit to the Circus, easily accounted for by his love of horses.

Unfortunately, a few days afterwards he developed a slight chill which again prolonged his enforced rest and he was unable to return to Rome until February 26th.

During his rest cure, all kinds of wild rumours were circulated. One day there would be a report that he was seriously ill, then an account would appear of the experiments he was carrying out in Italy.

In Italy, there was great disappointment that he had not been able to return for Christmas, as he had promised to broadcast on Christmas Eve. Actually a newspaper did report that his yacht had cruised off Rapallo on Christmas Eve, the truth being the *Elettra* was out of commission at the time.

It was also reported that he had no wireless set near him during his illness, but this was quite untrue. "It was," he said, "almost the first time I had been able to spend hours together listening to ordinary entertainment programmes from different parts of the world."

After his return to Italy in February, he remained in Rome, where as usual there were arrears of work awaiting him. At the end of June he again visited London, and this time in addition to business meetings, attended a number of seasonal and social functions, including a visit to Portsmouth, when he was the guest of the British Government for a day, during the Naval review. There he was much interested to see trials of planes controlled by wireless. During his stay in London his yacht was being got ready for his return, and when he left London, early in August, his intention was to board the *Elettra* at Santa Margherita Ligure, and to carry out more experiments with micro-waves.

Marconi is always loth to discuss his future experiments, and what he intends to do next. All through his career, he has been constantly chased by newspaper men and others who want to know just what his next step will be.

It is not always with a desire to be secretive that he sends his questioners "empty away" but because he does not always know what will happen next, or how certain experiments will develop. "Sometimes," Marconi has explained, "the ultimate end of an experiment may be pretty certain, but it is impossible to forsee how long it will take to perfect; very often a change has to be made in the line of development, an old idea scrapped because a new and better method has been discovered." (It will be recalled that Marconi first experimented with short waves in 1896, though they were then scrapped for long waves.)

It must be remembered that Marconi and the many experts who work with him, as well as those who are employed by the Companies, cover a very large field of scientific inquiry, and although Marconi keeps in close touch with them all, and even the smallest result is reported to him, he cannot always explain exactly what the next stage will be.

To-day everyone wants to know what Marconi thinks about television. How soon shall we all be able to see in? Will television invade the cinema? To all these questions he replies with a smile: "I am afraid we shall have to wait a while." He has said a good many times that television will not replace broadcasting, as we know it to-day, because people can often listen when it is not convenient to sit down and "see in." Just how soon television will be commercially applicable, he will not say. On the other hand, he is much more communicative about his micro-wave tests and experiments, with which he is continuing at present.

During those very successful experiments in July and August, 1932, he discovered that it was not correct to say that ultra short waves could not be received at points below the horizon. He said at that time: "I succeeded in hearing signals at a distance much greater than had formerly been believed possible."

In 1933, when the signals had been heard over an even greater distance, he was assured that the waves would not bend. Later there were signals at a maximum distance of 160 miles, sent from a station where the power used was only what could be obtained from a 25-watt generator. He

would not say whether the bending of the waves was due to the phenomenon of refraction or diffraction. "It may be," he explained, "that the ultra short waves are reflected by some unknown layer in the upper reaches of the atmosphere."

There is a sound-proof hut on the heights of Monte Rosa, above Rapallo, where experiments with these waves are being continually tried out by Mr. Matthieu, the Belgian wireless engineer, whom it will be remembered assisted Marconi on previous occasions. Marconi is convinced that micro-waves are capable of being employed in many more ways than we know of yet; we have only just touched on the field of their application.

Some months ago a number of experts were present at Genoa when it was demonstrated how a ship could be guided into harbour through a narrow entrance in a dense fog, by means of micro-waves operated from the shore. It is needless to comment upon such a discovery, the lives which may be saved through the use of it, the loss of cargo and money through shipping disasters, which may also be avoided.

Like Aladdin, when he discovered that the genii would appear to do his bidding merely at the rubbing of a ring, Marconi is sometimes thoughtful about the powers he has raised. He frequently says that he believes he and other scientist-inventors have only, so far, touched upon the fringe of what electrical waves are capable of achieving.

He is lucky to live in the twentieth century; in earlier days he might have been regarded as a magician, and what would have been more unfortunate, treated as such.

We are reminded of the treatment once meted out to those who made discoveries like Marconi, by that linking up of Marconi and Galileo on October, 1933, at the Chicago World Fair.

What a contradiction to those who say we have progressed little in matters of tolerance—Galileo at the Arcetri Observatory, condemned by the Inquisition in Rome to many years' confinement three hundred years ago.

To-day, His Holiness the Pope placing the grounds of the Vatican at Marconi's disposal for short-wave experiments—Marconi and the Pope in conference for over two

hours, said to be the longest conference His Holiness has ever held with a layman. . . .

Traffic control, television, maybe a hundred other uses for wireless—all lie in the future—he prefers not to forecast.

To those who still enquire if we shall ever be able to wireless to other planets Marconi says: "If you are assured that there are intelligent beings inhabiting them, we perhaps might be able to do so. I would not say that it will always be impossible."

CHAPTER XIX

"MARCONI" MEN AND THE SCHOOL OF WIRELESS

NO story of Marconi's life would be complete without some reference to the Marconi men who are to be found all over the world, and belong to every nationality.

It was a real joy to Marconi to find during his world tour in 1933 that the activities of Marconi-trained men were so widespread.

"The men are doing fine work everywhere," he said afterwards. Naturally Marconi does not know the names of the men who work for his Companies, much less of those who pass through the School of Wireless—he nevertheless keeps in touch with their training and activities and makes a point when possible of attending any of their social functions; this year (1935) he went, accompanied by the Marchesa Marconi, to present the prizes at their annual sports. . . .

As early as 1901, it was found that some kind of special tuition was necessary to initiate those who wished to join the Marconi Company staff in the application of electrical theory to wireless, and so the first Marconi School was opened at Frinton.

The contrast between the training provided at the Frinton School and the Marconi School, better known as Chelmsford College, to-day is astonishing.

In 1901, the students who came to Frinton had already passed through some recognized engineering college and their training consisted of being taught the Morse code and the best methods of fixing and repairing the crude apparatus used at that time. As wireless progressed and the activities of the Company expanded, the Marconi school course had to be placed on a more scientific basis. In 1904, the school was moved to Chelmsford, so that students were able to supplement their theoretical tuition with practical application in the Marconi works.

In 1914, at the outbreak of war, the Marconi School was closed for a while, until the War Office chiefs requested Mr. H. Dobell, M.A., A.M.I.E.E., who had been in charge of the school, to organize a training camp, where a number of officers and men could be trained to erect, operate, and maintain various types of field wireless equipment.

This training school, which was actually a continuation of the Marconi school, proved invaluable to the Allies. From it were turned out a number of thoroughly trained, highly skilled men, who were later employed in military, naval and aircraft wireless operations.

As a result of excellent work done by Marconi men during the war and the realization by the Company that others might like to make use of the facilities which the school offered, they undertook to train any men who wished to take special courses of tuition in wireless telegraphy, in addition to training only their own staff, which had been their earlier policy.

As soon as this intended extension of the Marconi school course became known, the Company received applications from all over the world, and in consequence additional accommodation had to be found as soon as possible. In order to provide this additional accommodation the Marconi Company acquired the building and grounds which are now known as Chelmsford College. As soon as this College was opened, a member of their staff, Mr. A. W. Ladner, A.M.I.C.E., was chosen as head. Not only had he had a very wide experience in wireless engineering, but he possessed the ability of being able successfully to impart knowledge to men of all grades of education and to all nationalities, the latter often a difficult matter with the disadvantages of language.

Chelmsford College, which is on the top of a hill, just outside the Essex town of that name, is only about twenty minutes walk from the famous Marconi works at Chelmsford. Many students live in London during their training, but there is residential accommodation for about a dozen men.

The instruction given to students is frequently varied to suit individual cases, although, of course, the main object of the College is to impart sufficient knowledge to enable a

student to install and maintain practical wireless apparatus.

Marconi himself has always, from earliest days, been a keen advocate for practical training for wireless engineers, rather than academic and mathematical. Experimental demonstration of the right and wrong method of doing things has been found the most effective method for general training, and except in special cases training is kept as general as possible.

Therefore, in addition to the instruction imparted in the College, nearly all the students spend a certain amount of time in the workshops and test-rooms of the Marconi works. where they can see the methods employed in constructing and assembling wireless apparatus.

In some cases, the students are also given instruction at commercial wireless transmitting and receiving stations. The proximity of the College to the Marconi inter-Continental group of wireless transmitting and receiving stations at Ongar and Brentwood is a great convenience for this, and whenever opportunity permits the students are taken to these commercial stations by instructors from the College.

On the completion of their course, students have to pass examinations in various subjects which they have studied; afterwards they are given a certificate by the Marconi Company indicating their proficiency.

It would take too long to enumerate the various types of work undertaken by Marconi men throughout the world. Marconi had been surprised on many occasions to discover what varied jobs have been undertaken by these men.

To the majority of people, the term wireless engineer conjures up the impression of a ship's wireless operator. This is probably due to the fact that it was at sea, as the means of saving life, and effecting rescues, that wireless men became known to the public. Entirely forgotten are many of the spheres in which wireless has come to be employed since its commercial development and recent expansion. Manufacturers have to employ fully qualified wireless engineers as specialists, not only to design apparatus, which is, by the way, rapidly becoming more standardized, but to test and pass all manner of apparatus, from marine outfits to all the intricacies concerned with broadcasting and wireless

sets. Many of the younger generation are inclined to imagine that all wireless means broadcasting, when actually the branch of wireless known as broadcasting is really only a gigantic sideline, and although a large number of wireless engineers are employed in all parts of the world in the running and maintenance of broadcasting stations, they account for a very small number of men compared with those employed in other spheres of wireless.

Delighted as Marconi is that his discovery should have brought so much happiness into the world in the form of entertainment, he is still more interested in the extremely large number of lives which have been saved by wireless, and of course this has always been, and will remain, the most spectacular aspect of wireless communication at sea. Marconi would like to see every trawler and fishing-boat which has to travel over considerable distances, installed with wireless, and recent experiments have been made with a view to making cheap and effective installations, which would operate up to about 100 miles, which every one of these boats could afford to carry.

In the largest ships to-day, especially the Atlantic liners, the wireless installation far exceeds the minimum which is required by the Board of Trade regulations. As the years have passed the range of apparatus has been voluntarily extended until these ships all carry such powerful installation that reception and transmission to and from any spot on the globe is possible. In addition, however, to these "luxury" installations, the regulations compel every British sea-going vessel of 1,600 tons and over, to carry the prescribed emergency apparatus, which can be effectually operated when dynamos are silent and all the ship's power cut off—a plant both self-sufficing and self-contained—in the hands of the operators in the wireless cabin.

Ever since the International Convention of 1913, British ships have followed out the proposal then made, that ordinary wireless work should be suspended for three minutes, at fifteen minutes and forty-five minutes past the hour, Greenwich Mean Time. During these "Silence Periods," as they are generally known, British wireless operators listen for calls of distress and warning. To answer and rush to the

assistance of a ship which sends out a call of distress has now become such a commonplace, that few recall how short a period has elapsed since a ship in distress had only vague hopes on which to depend. To those in peril at sea, the first transatlantic signal in 1901 was an even greater revolution than the introduction of steam ships in the place of sailing vessels.

In the course of the story of Marconi's life, many instances have been quoted of the good work done by wireless at sea—*Titanic*, *Volturno*, *Columbian*, *Empress of Ireland*, *Lusitania*, *Laurentic*; each one an epic story.

Naturally the most interesting side of the work carried out by Marconi men will remain the "research side," for only by prolonged research are discoveries made, and how often one "find" leads to another.

In writing of "Wireless as a Career," Mr. R. N. Vyvyan, Marconi's famous assistant, says:

"From time to time research engineers, while engaged on other studies, make inventions of fundamental and great commercial importance. For instance, Franklin, during his intensive research into short-wave communication, and arising out of his experiments with parabolic reflectors, one of Marconi's earlier inventions, devised the flat grid aerial, which became world-famous as the beam aerial."

Another example, he cites, is how the circuits invented by Round and Wright, in connection with the Bellini-Tosti method of Direction-finding, which were patented, are responsible for the high degree of accuracy to which modern direction-finding gear has attained.

Quite apart, however, from research work, Marconi men are called upon to carry out duties which should place them among the ranks of diplomats and foreign ministers.

In many of his speeches, as well as in conversation with friends, Marconi has stressed the importance of wireless in bringing about the future peace of the world and linking up nations so that they are no longer strangers to each other, but this good work is not possible until the necessary stations have been installed and methods of running them agreed upon. The work of choosing sites for stations, of negotiating with Government officials and local authorities,

often calls for great tact, and an ability to deal with men of all grades and types—to say nothing of the infinite patience and tact which is also needed upon many occasions. Many stations "East of Suez" are a monument to such diplomacy.

Imagine, also, how much diplomacy of a rather different grade is needed by an erecting engineer who has to deal with men of all grades of civilization as well as temperament—a knowledge of certain languages is not the only necessary attribute.

The great stations in China, Manchuria, and Mongolia, were chiefly the work of Marconi, and the task of erecting and installing a wireless station in a country where governments change almost weekly, and bandits are as common as blackberries in September, is not an easy one—but then the whole story of wireless and its inventor has been a story of the continual triumph of perseverance over obstacles, once believed unsurmountable. Marconi's own career is their inspiration.

CHAPTER XX

FUTURE DEVELOPMENTS

AN important link with the earlier days of wireless was severed when, in 1933, it was decided to dismantle the historic station at Poldhu.

For some years previously it had been used only as an experimental station; with the coming of a more up-to-date system of stations it was decided that there was no further use for Poldhu.

To the student of wireless history Poldhu will remain a great landmark; in the first place because it was from there that the first signal was transmitted across the Atlantic, and also because of the tremendously important part it played in wireless development during subsequent years.

Royalty, and famous men and women from all over the world, had visited Poldhu and marvelled at the wonders the station had to show, enjoying on their journey to and from the station the lovely stretch of Cornish scenery.

Records of these visits were preserved in the visitors' book which is now on show for posterity at the neighbouring Mullion Hotel. One entry of particular interest was made in 1903 when the present King and Queen of England, then Prince and Princess of Wales, signed their names, together with Prince George of Teck and Lord Falmouth.

It was thought best that this book, among other relics, should remain in the district so that future visitors would not be too much disappointed when they found that the site of the station had been used for building purposes.

Some compensation for the passing of Poldhu may be found in the fact that Carnarvon is still doing useful work, although this station is not old enough to have the sentimental associations of Poldhu; it is of historical note, if only for the important part it played in the development of Empire wireless communication, including, of course, the first message to Australia.

To-day the Carnarvon station is used by the Traffic Department of Imperial and International Communications, Ltd., to assist services which at times become difficult on short waves, and also for picture transmission.

The principal beam transmitting centre is at Dorchester, and at this station are installed eight or nine short-wave transmitters. Five masts stand in a line, at right angles to the great circle which bears on New York, which supports four bays of beam aerials in the direction of New York. In the opposite directions are aerials for communication with Egypt and the East. There are other sets of aerials for communication with South America and Japan respectively.

The station at Somerton acts as a complementary receiving station to the transmitting one at Dorchester.

It has already been remarked how much Marconi differs from other inventors, in possessing a keen business sense, and although he has not been personally responsible for many of the contracts and arrangements entered into by the Marconi Company, he has been a great power in influencing the enormous commercial development of wireless which has taken place since the war. It was Marconi who foresaw many years ago the amount of business which could be done by linking up European centres and establishing a wireless network throughout the Continent, as apart from the important field of transatlantic communication.

The Marconi Company to-day controls, or is in working agreement with a number of companies which have been established in many countries to deal with wireless traffic of all kinds.

Furthermore, the British Post Office granted licences, with restrictions, so that the Marconi Company could establish communication with France, Switzerland, and several other countries.

After a time it was decided that transmitting and receiving stations erected near London would be more serviceable, and they could be more easily controlled from the Central Wireless Telegraph Office, which had been established in London as a centre for the distribution of wireless. As a result of this decision a site was chosen at North Weald,

Ongar, Essex, and a corresponding receiving station was erected at Brentwood.

Shortly after Marconi's successful short-wave tests, extensions were made and short-wave transmitters were installed at Ongar, in addition to the long-wave ones already installed.

About 1923 the long-wave reception from America, which had been received previously at Towyn, a receiving station near Carnarvon, was transferred to Brentwood. As the short-wave traffic continues to increase, the Brentwood station is extended and further short-wave receiving apparatus erected. Indian and Australian messages are received at the beam receiving station at Skegness, and those from South Africa and Canada at Bridgwater. Although the Brentwood station frequently receives messages from New York, South America, Egypt and Japan, the principal centre of reception for these messages is at the Somerton station.

Much internal delay has been obviated during the past years by the merging of cable and wireless interests.

In making a more or less general survey, which is bound to be rather incomplete, of all that Marconi's discovery has achieved in the field of commercial communication, some mention must be made of the Post Office radio station at Rugby, which was first brought into use in January, 1927.

Originally it was intended that this station should provide radio-telegraphic communication to all parts of the Empire, but certain amendments have been made to this arrangement. It fulfils many important functions; it is the transmitting station in the outward direction from Great Britain for all the overseas radio-telephone services, operated by the British Post Office, and it is equipped for transmission on both long and short waves. It is also from this station that ships at sea are provided with time signals, meteorological reports, and long-distance messages. News is also broadcasted from this station, which possesses the most powerful valve transmitter in the world.

The long-wave aerial system is supported on twelve insulated steel masts, each 820 feet high and weighing about 200 tons. They are triangular in shape, with sides which have a width of 10 feet; each mast is stayed with five sets of

stays, placed at intervals of about 160 feet throughout its height and is pivoted 17 feet from the ground, on a porcelain insulator which is supported on granite blocks. Each mast is constructed to withstand a horizontal pull of ten tons at the top and a wind velocity of 140 miles per hour. The earth system consists of buried copper wire. It follows the plan of the aerial and extends 800 feet on either side of the vertical projection of the aerial on the ground.

The short-wave aerials are carried in self-supporting steel lattice towers and so far twenty-seven short-wave directional aerial arrays have been erected at Rugby. There are also seven short-wave transmitters, each one of which is capable of operating successfully on three or four wave-lengths in the 15, 60-metre band.

This gigantic station consumes about five million units of electric current every year and high tension current can, by means of special generating machines, be supplied to the plates of the valves of the long-wave transmitter at a voltage as high as 18,000 volts.

In radio-telephony, in order to prevent inner action between incoming and outgoing speech, the two are made to follow different paths. This has to be done by separating the transmitting and receiving stations at either end. The receiving stations in Great Britain which work in conjunction with the transmitters at Rugby are at Cupar, in Fifeshire, and Baldock, in Hertfordshire.

The reason the site at Cupar was selected was because it was believed to be a most suitable spot for reception on long-waves from the United States of America, that there would be the maximum freedom from interference from unwanted radio signals and atmospherics. The highly directional selectivity is achieved by a specially designed aerial, which is laid out to receive from the direction of the transmitting station of the American Telephone and Telegraph Company station at Rocky Point, Long Island, which was inspected by Marconi during his 1933 tour.

The long-wave radio receiver itself is of special design. It has to perform the important function of replacing the carrier frequency suppressed by the transmitter at Rocky Point. Since the quality of the received speech depends so

much upon this, special arrangements have been made for its accurate performance by the receiver.

The receiving equipment for the short-wave services is situated at the Baldock station and the three radio stations, Rugby, Cupar, and Baldock, are linked with the Overseas Telephone Exchange in London by underground cables.

Though Marconi in those early days at the Villa Griffone dreamed of the day when voices would be heard through the air across vast distances, it is doubtful if he ever visualized the intricate network of communications which his invention would bring about, or the world-wide system which would develop from one faint signal.

To the average person to-day, a radio call to New York or Melbourne means little more than the monetary cost of it. Few would recall what inventions have made the feat possible, and probably quite a number would be unaware even of this method used to transmit the call. The thirty years of progress, since that primitive equipment at the Haven Hotel, passes unnoticed.

Take as an example a radio call between Paris and New York. The speech channel consists of an ordinary line circuit between Paris and London, a radio link between London and New York, and a line extension from New York to the American subscriber to whom the call is directed.

There are two systems in general use for providing the radio link, one utilizing long and the other short waves. In the case of a call set up on the long wave radio link, the incoming speech over the line from Paris is sent from the London trunk switchboard, via the London radio terminal to Rugby, where it is amplified, filtered, and passed on to the radio transmitter. The radio currents generated in the primary stages of the transmitter are subsequently controlled by these speech currents, the result being amplified in successive stages before passing to the aerial system. In this way the speech currents from Paris are radiated into space at a power which is several million times greater than that at which they arrive at the radio station.

When they arrive in America, the currents, which are now very much weaker than when they were passed to Rugby from the Paris line, are picked up on the aerial system

at Houlton (Maine), from there they are passed to a radio receiver and after amplification they are sent to the American subscriber through the New York radio terminal switchboard.

In order to counteract variability of transmission over the radio link and to ensure full loading of the radio transmitter on all conversations, the strength of the speech currents is kept under continual control by a technical operator at the radio terminals. Privacy during the conversation is ensured by rendering speech quite unintelligible to the operating staff and to any others who may happen to tune in on the radio channel. This is done by means of devices which are known as "inverters," "scramblers," and "wobblers."

The advantage of the short-wave system over the long, in a case like this, is the reduced power which is required at the transmitter and a less elaborate and expensive aerial system. As atmospheric conditions are ever changing it is found that sometimes the long-wave system gives the best results and other times the short, so the two systems are used according to the conditions which prevail at the time.

Actually the first short-wave transatlantic service was opened by the Post Office in 1928; now the various improvements and developments which have been introduced have resulted in England becoming the greatest centre of radio telephonic communication in the world.

If so much has been achieved for business communication mainly through Marconi's great discovery, how may wireless affect other phases of life? What influence will wireless have upon warfare? Its utility as a means of short distance communication was amply proved during the Great War, but wireless was far behind its present stage of development in 1914. Marconi himself will never discuss all the uses to which his invention might be put in the case of war. Direction-finding wireless did great service to the British Navy during the war, not only in connection with the Fleet but in connection with the location of Zeppelins—in war to-day the wireless control of aeroplanes would most certainly play an important part; in addition there are undoubtedly many uses to which wireless control could be put.

It is not only in military aviation that wireless could and does play an important part—many long-distance flyers owe

not a little of their success to wireless. Communication from a damaged plane may save the pilot from death in a jungle or desert. In the case of air-liners weather reports transmitted by wireless have prevented many accidents, because the liners have been able to avoid fogs or gales which might have caused serious damage. There is no doubt that not only will this work continue, but many more developments will be effected.

Wireless has also played an important part in police work since that far-off day when Crippen was arrested through its use. Rapid communication by means of radio has prevented the escape of such people as car bandits, and to look at the other side of the picture, has been the means of finding missing persons, and radio calls and S O S broadcasts have brought people to the bedsides of injured or dying relatives and almost daily these and similar services are being extended and improved.

An almost untouched field for wireless, but which promises most important developments, exists in the field of medicine. It will be remembered that only a year ago Marconi was called upon to preside at the Conference of Radio Biologists which was held in Venice, and he is very anxious to see micro-waves utilized in many more ways than at present by the medical profession.

"If the waves I have discovered can ease pain and cure certain forms of disease, I shall indeed be happy," he has said many times, but obviously it is the medical men who will have to carry out many of the future experiments in this field.

A German scientist has invented a device which consists of headphones such as used to be connected with all wireless sets; by means of this apparatus electric waves are passed through the head, and neuralgia, headaches, toothache, etc., are cured. Rheumatism cured by radio will be a commonplace of the future.

Marconi foresees the increased use of radio in the home, when housewives will not only be able to use radio as an entertainment, but it will provide her with power to perform some of the simple butted ious tasks, such as beating eggs, running a sewing machine, and so on.

Again, there is an important field for wireless development in traffic control. In the case of important processions such as the Silver Jubilee celebrations, traffic was regulated by broadcasts from vans along the route, and this method is now common upon occasions when there is likely to be a very large crowd.

During an interview, Marconi once suggested a number of ways in which traffic might be controlled by wireless. For example: "At dangerous corners and cross-roads, traffic scouts stationed in 'sentry boxes' could radio to the next crossing how many vehicles had passed and in which direction they were travelling. Furious driving could be easily checked. It would be useless for a driver to plead, when summoned, that he had been travelling at only thirty miles an hour when the wireless record proved quite differently. Many accidents on main roads are caused by cars appearing without warning from side roads. Automatic traffic signals worked from wireless outposts could control drivers emerging on to the highway," and this is only touching on the fringe of what might be achieved.

The future developments of broadcasting are too obvious to need description; wireless enthusiasts will see they get what they want as time goes on. Melba's broadcast in June, 1920, a few hundred listeners; rather more than 7,000,000 homes in Great Britain have a wireless set to-day—and the Radio Show at Olympia, London, gives an idea of the magnitude of the radio industry from the entertainment point of view. Greater selectivity and the cutting out of all interference are the chief aims of broadcasting to-day.

It may not be long before American programmes will be heard as easily in London as those from Paris or Rome are now. Short-wave broadcasting has brought about many improvements, such as a reduction in interference and greater clarity of reception, but long-distance communication by means of short-waves is apt to be rather imperfect at times, owing to "fading." This is sometimes a drawback even on telegraph service, but by means of complicated aerial systems this can be adjusted, or at any rate considerably reduced. The cost of such a method would make it quite prohibitive to the ordinary listener. Slow fading is due to

the inconstancy of the ionized layer in the upper atmosphere, from which the waves are reflected; during the hours of darkness this ionization is reduced, but as the sun rises it is increased.

Quick fading which takes place in a rather different manner has practically been eliminated from such stations at those which relay Empire broadcasts, and as development continues this improvement will be extended.

The great question of the moment, of course, is when may we expect television to play an important part in our daily lives. The Postmaster-General has stated recently, that it will be in practical use in six months; most people consider this an optimistic outlook.

As already stated, Marconi will not prophesy about this newcomer, except, he says: "*There is a great future for television.*" However, to take a general survey of the matter, many people forget that television will have to be much more perfect in comparison than broadcasting was before it is popularly accepted. There are several reasons for this, and a brief summary of them will assist in estimating what progress may be expected within the next year or so.

First, it must be remembered that the eyes demand greater perfection than the ear. A distorted sound, a voice "off the note" passes unnoticed by the average listener, but everyone notices a distorted face or figure. In television, interference and atmospherics are visible, the whistle from the "other fellow's" set becomes a flash of light and so on. When radio sets first came into vogue, people marvelled at any sound, however distorted it happened to be, but such conditions do not exist to-day; modern science has educated us and widened our outlook; more perfection is demanded in everything.

Then there is the question of cost. In 1920 when the great rush for wireless sets took place, and there were not sufficient manufactured to meet requirements, ingenious men built their own and a simple crystal set could be installed for a matter of £1 or 25s., even at that stage of development.

A television set is a very different and much more difficult thing to deal with—and very much more expensive. A good cathode ray valve costs about £25 and it does not last very

long, either. A number of people would expend this amount if they were certain of results, but as things are they prefer to wait and see. In 1934, a Government Committee was set up to consider the question of Television, with Lord Selsdon as chairman; the report on their proceedings was issued in January, 1935.

It was decided that, owing to the close relationship which exists between sound and television broadcasting, the same authority should be responsible for both. The Postmaster-General should forthwith appoint an Advisory Committee on which the Post Office, the Department of Scientific and Industrial Research, and the B.B.C. should be represented. The committee to be appointed for a period of five years.

Ultra-short-wave transmitting stations should be situated at elevated points and the masts should be as high as practicable. Another point that the Committee decided was that they thought it desirable in the general interest that a comprehensive television patent pool should be eventually formed.

The Baird Television, Ltd., and the Marconi E.M.I. Television Company, Ltd., should be given an opportunity to supply, subject to conditions, the necessary apparatus for the operation of their respective systems at the London station.

It was also decided that it would be in the light of the experience gained with the first station, the Advisory Committee would proceed with the planning of additional stations, until a network of stations had been built up.

Also that there should not be any separate licence for television reception at the start of the service but the question would be reviewed later.

A number of other suggestions and clauses were included, and it was estimated that the cost of a television set would range from £50 to £80.

The cost of the upkeep of a station until December, 1936, was considered, and such items as the rising cost of programmes, etc. However, at the present time the Alexandra Palace, in North London, has been chosen as a suitable spot; it stands high and will therefore suffer less from interference, and before very long Marconi's Company and the rival one

will demonstrate what can be done. According to the stipulations laid down by the Government, both systems must be operated on the same type of instruments. So matters stand at present, and thus we must leave them, hoping—and recalling that success when an electric bell rang in an attic room in the Villa Griffone nearly forty years ago. . . .

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1902 Grand Cross of the Order of the Crown of Italy.
1905 Chevalier of the Civil Order of Savoy and appointment to the Supreme Council of that Order.
1912 Grand Cross of Alfonso XII.
1914 Knight of the Grand Cross of the Victorian Order.
1919 Italian Military Medal (awarded for special service during the Great War).
Senator of Italy (corresponding to Privy Councillor).
1929 Italian Marquisate.
1931 Order of Pius.
1931 (Nov.) Grand Cross of the Order of Malta.
Grand Cross of the Sovereign Sacred Order of St. John of Jerusalem.
1933 Grand Cordon of the Order of the Rising Sun (Japan).

PRESIDENCIES

Italian Royal College of Science. (The President becomes a Member of the Council of the Fascist Party which corresponds to the British Cabinet. It also carries the right to be addressed as His Excellency.)
Italian National Scientific Research Council.
Royal Society of Arts (Past President).
Birmingham and Midland Institute (Past President).
The Columbia University Club of G.B. (Vice-President).

FELLOWSHIPS

Royal Society of Sweden. Royal Society of Arts.

HONORARY MEMBERSHIPS

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Institution of Mechanical Engineers (London).
Institution of Electrical Engineers (London).
(*Past member of the Council*).

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Institution of Electrical Engineers (London).
Institution of Junior Engineers.
Institute of Radio Engineers (New York).
Royal Institution of Great Britain.
Reale Accademia dei Lincei (Royal Society of Rome).
Italian Institution of Electrical Engineers.
Italian Institution of Engineers and Architects.
Italian Faculty of Science.
Italian Venetian Scientific Society.
Association des Licencés de l'Université de Liège.
American Institute of Electrical Engineers.
American Philosophical Society.
New York Electrical Society.
Papal Academy of Sciences.
National Academy of Sciences (U.S.A.).

HONORARY DEGREES

Doctor of Engineering, Bologna University.
Doctor of Science, Oxford University.
Doctor of Law, Glasgow University.
Doctor of Law, Aberdeen University.
Doctor of Law, Liverpool University.
Doctor of Law, Pennsylvania University.
Doctor of Law, Louisiana University.
Doctor of Law, Columbia University.
Doctor of Law, Cambridge University.

AWARDS, GOLD AND SILVER MEDALS

Nobel Prize for Physics, 1909.
Albert Medal, Royal Society of Arts (annual award to scientists).
Gold Medal of the Institute of Radio Engineers, New York (annual award).
Gold Medal of the Franklin Institute, Philadelphia (annual award).
John Fritz Medal and Diploma (annually awarded jointly by the Institutes of Electrical Engineers and Mining Engineers in America for outstanding achievements in applied science).
Gold Medal, Bologna University (30th anniversary of wireless invention).
Ne Plus Ultra, Spain (awarded the same year to Raold Amundsen).
Gold Medals of Scientific Institutions and Associations in Bologna, Florence, Venice, Madrid, London, Philadelphia (John Scott medal).
Silver Medal of the International Mark Twain Society.
Kelvin Medal (awarded triennially by the Institution of Civil Engineers, London).
Freedom of the City of Rome, 1903, and other Italian cities.
Freedom of Genoa, 23rd May, 1931.
Goethe Medal and Diploma, awarded by President von Hindenburg, 1932.
Lieutenant, Italian Army, 1914, promoted Captain, 1916, and transferred to Italian Navy in the same year as Commander.

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